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Why is Officer PME important for the Indonesian Air Force?

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Abstract

Professional Military Education (PME) is vital for developing strategic leadership in air forces, yet its empirical impact on the Indonesian Air Force (TNI AU) remains under-researched. This study empirically examines the contribution of PME factors to the development of air power strength. Utilizing a quantitative approach, survey data were collected from 412 officer graduates (2019–2024) of Sekkau and Seskoau. Data were analyzed using multiple linear regression to determine the influence of curriculum, teaching staff, teaching methods, quality control, and research.The findings indicate that these factors collectively explain 79.6% of the variance in air power development. Specifically, curriculum, teaching methods, and quality control emerged as significant positive determinants ($p < 0.05$), whereas teaching staff and research did not show a significant direct influence. These results suggest that while the systemic framework is strong, optimization of human resources and research integration is required. Priority should be given to pedagogical innovation and quality assurance to accelerate the strategic capabilities of adaptive officers.

Keywords: education, military, professional military education, sekkau, seskoau, TNI AU

INTRODUCTION

The development and enhancement of air power, as mandated by Law No. 34 of 2004, is no longer merely a static legal requirement but a strategic necessity driven by a rapidly evolving global security landscape. In the contemporary era, air force capabilities are increasingly defined by the mastery of Multi-Domain Operations (MDO) and Network-Centric Warfare (NCW), where the seamless integration of kinetic assets with cyber, space, and electronic domains is paramount. This urgency is further compounded by the emergence of asymmetric threats, such as drone swarms and long-range precision strikes, which demand that military officers possess advanced intellectual agility and strategic foresight beyond traditional flight training. Furthermore, regional data from *The Military Balance* (IISS) and *Flight Global* highlight an intensive modernization trend among ASEAN neighbors, transitioning toward 4.5 and 5th-generation platforms that prioritize

superior technology and data-link integration (Flight Global, 2025; The International Institute for Strategic Studies, 2025). Consequently, for the Indonesian Air Force (TNI AU), human resource development through Professional Military Education (PME) becomes the critical dependent variable; without personnel capable of navigating these complex operational dynamics, physical modernization remains under-optimized for maintaining national sovereignty in an interconnected security environment (Syme-Taylor & Jalili, 2018).

Recent global scholarship has increasingly focused on establishing best practice principles for Professional Military Education to ensure its relevance in complex security environments (DuBois et al., 2017; Goode, 2019b; Pearse, 2009; Sheringham, 2022; Williams, 2013). Goode (2019) emphasizes that effective PME must be underpinned by a literature-based framework of quality indicators, including curriculum relevance, faculty expertise, and the integration of diverse pedagogical methods. This is complemented by Sheringham (2022), who analyzes PME as a critical institution for shaping military professionalism, arguing that educational structures must evolve to reflect the ethical and strategic demands of modern warfare. These studies highlight that PME is not merely a technical requirement but a sophisticated institutional mechanism for developing the thinking soldier capable of navigating non-linear threats. In addition, there needs to be the development of specialised knowledge that enables one to lead and control at a higher level. This specialisation process requires time and effective management to ensure that individual and leadership development can be realised (DuBois et al., 2017)

Professional Military Education (PME) is a structured framework for preparing military personnel to become leaders, strategic decision-makers, and operational experts through the integration of traditional academic knowledge with specialised military training (Williams, 2013). In the specific context of air force development, research underscores the necessity of tailoring education to high-technology operational environments. Pearse (2009) argues that air force officer education must prioritize long-term strategic leadership and adaptability to keep pace with the 2035 operational horizon, emphasizing that the intellectual component of air power is as vital as technological superiority. Within the Indonesian context, empirical evaluation of the Air Force Squadron Officer School (Sekkau), identifying that the alignment between curriculum design and human resource competency is a fundamental determinant of organizational success (Novita et al., 2024). By synthesizing these global best practices with localized evaluations, the current study seeks to fill the gap in empirical data regarding how specific PME factors, curriculum, methods, and quality control, collectively drive the modernization of Indonesian air power.

PME is implemented to encourage critical thinking, adaptability, and competency development, equipping personnel to face complex and evolving security challenges (Kelly et al., 2024; Murtazashvili & Shine, 2024). Currently, the integration of cutting-edge technologies, such as artificial intelligence and machine learning, in PME ensures that military professionals keep pace with developments in modern military conditions and technologies (Cieślak, 2018). Additionally, PME now incorporates experience-based learning and scenario-based approaches to bridge the

gap between personnel's theoretical understanding and practical application, thereby enhancing operational readiness (Murkhejee, 2018).

PME in the Indonesian Air Force is implemented through a tiered education program that includes basic, advanced, and specialized education at the Air Force Command and Staff College (Kodiklatau, 2017). The types of general development education gradually start from the level of the Indonesian Air Force Squadron Officer School (Sekkau), the Indonesian Air Force Command and Staff School (Seskoau), followed by the Indonesian Armed Forces Command and Staff School (Sesko TNI), which is organised by Sesko TNI as the implementing agency of the Indonesian Armed Forces Headquarters (Indonesian National Armed Forces, 2008). This education is designed to prepare personnel for operational and strategic tasks. The PME curriculum in the Indonesian Air Force integrates technology-based training, including flight simulation, modern radar systems, and UAV mastery (Soleh et al., 2019). Additionally, the TNI AU collaborates with international institutions for overseas training, thereby enhancing personnel competencies to global standards (Priyanto & N., 2022).

PME, which originated in Europe in the 17th century, has a rich history and was initially designed for military officers. This education was further developed in the United States, which had a significant influence on the formation of the global PME system. One of the important milestones in the history of PME was the establishment of the United States Military Academy (USMA) in 1802. This was followed by the establishment of other military academies, such as the USNA and USAFA (J. M. Bell, 1986). These academies have produced many prominent military leaders who have made significant contributions to global military strategy. Although the term PME is not widely used in the TNI environment, the concept has been applied in practice within the TNI education system. PME in Indonesia began with the establishment of the National Military Academy (Akmil) in Magelang, which currently produces Indonesia's national leaders (Supriyatno, 2014).

Military academies in various countries prioritise the development of professionalism and specialised skills in the military field, including military academies in Indonesia. After completing basic education at military academies, officers continue their higher education according to their specialisations at specific institutions. One such institution is the Air University for the United States Air Force (H. H. Bell & Reigeluth, 2014; J. M. Bell, 1986). This model has inspired many countries to develop their own PME systems. Further education for the Indonesian Air Force is provided through educational institutions such as Sekkau, Seskoau, and Sesko TNI. The PME concept encompasses not only the curriculum and teaching staff but also teaching methods and quality control, serving as a reference for improving the quality of military officers at various levels (Kusiani et al., 2021). Therefore, this article presents a discussion on the PME model in the Indonesian Air Force and explains the importance of PME for officers in the Indonesian Air Force through a survey conducted on PME officer graduates from 2019 to 2024 using a quantitative approach.

The urgency of this research is rooted in the current lack of a structured and transparent framework for Professional Military Education (PME) within the Indonesian Air Force, which directly hinders the professional development of its officers in facing modern operational challenges. While previous studies on the TNI AU have primarily relied on qualitative or historical perspectives to describe educational functions, this research presents a significant methodological novelty as the first to empirically examine PME factors, specifically curriculum, teaching methods, quality control, teaching staff, and researches using a quantitative approach and multiple linear regression analysis. Practically, it identifies specific systemic deficiencies, such as the significant and non-significant impact, then offering Indonesian defense policymakers a data-driven roadmap for prioritized reforms in pedagogical innovation and quality assurance.

METHOD

This study utilizes a quantitative research design to objectively measure the influence of Professional Military Education (PME) on the development and advancement of air force strength. According to Creswell (2014), a quantitative approach is essential for testing theories by examining the relationship among variables, which can be measured and analyzed using statistical procedures. The research analyzes five independent variables, curriculum, teaching staff, teaching methods, quality control, and research, to determine their impact on the dependent variable of air force development. Primary data were collected through a questionnaire-based survey designed to capture the perceptions of Indonesian Air Force officer graduates from the Air Force Squadron Officer School (Sekkau) and the Air Force Command and Staff College (Seskoau) 2019-2024. This process also incorporated a tracer study element to evaluate the long-term professional impact on graduates. The collected data were processed using IBM SPSS Statistics software, involving a series of rigorous tests including classical assumption tests (normality, multicollinearity, and heteroscedasticity) followed by multiple linear regression analysis to validate the research hypotheses.

This paper explores the relationship between Professional Military Education (PME) and the development and strengthening of the Defence Force of Indonesia. A quantitative research approach was used to describe the relationship between variables objectively and measurably (Creswell, 2013). The research locations were selected using purposive sampling, including the Air Force Command School (Sekkau) at Halim Perdanakusuma Air Base and the Air Force Staff and Command School (Seskoau) in Lembang, as well as Kodiklatau, the Indonesian Air Force Personnel Staff, and Disdikau, which serve as policy-making and education implementation institutions. The research population consisted of 799 officers who graduated from the PME between 2019 and 2021. The sample size was calculated to be 412 people using the Slovin formula with a 5% margin of error.

The sample was taken using simple random sampling, which refers to the relatively homogeneous population conditions (Neuman, 2014). There are two main variables, namely PME

as the independent variable (X) and the development and strengthening of air power as the dependent variable (Y). PME is analyzed through five factors based on P.H. Coombs' theory: curriculum, teaching staff, teaching methods, quality control, and research, which are the main elements of successful military education (Coombs, 1970). The dependent variable is measured through two main indicators, namely outcome (the contribution of PME to individual graduates) and impact (the impact of PME on the organisation). The relationship between these factors and the two indicators is presented in Figure 1.

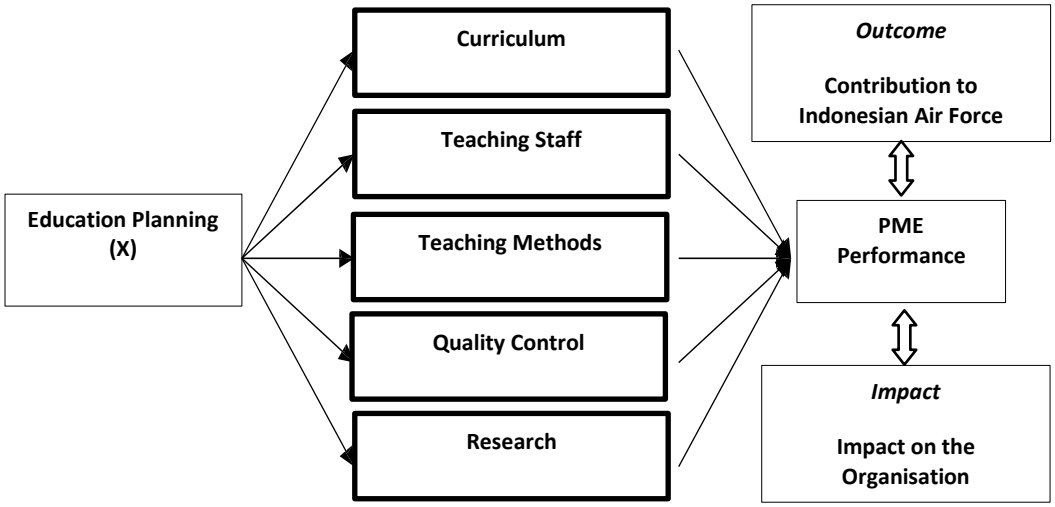

Figure 1. Relationship between factors influencing PME and its impact on air force strength

Data were collected through various methods, including Likert scale questionnaire-based surveys, in-depth interviews with high-ranking Indonesian Air Force officials, direct observation of teaching and learning activities at PME institutions, and studies of official documents from relevant institutions. The questionnaire was tested for validity and reliability before use to ensure measurement accuracy (Sugiyono, 2004). This technique enables the collection of both primary and secondary data to produce a comprehensive analysis. Data analysis was performed using descriptive and inferential statistics. Pearson's correlation technique was used to test the relationship between PME and strength development variables, while multiple regression analysis was applied to determine the contribution of each PME factor to the dependent variable (Field, 2018). The validity and reliability of the instruments were tested prior to data collection to ensure the quality of the data obtained (Sugiyono, 2004). The results of this study are expected to provide an in-depth understanding of the effectiveness of PME in building air power and to offer strategic recommendations for the development of military education in the Indonesian Air Force, as well as for enhancing military education policy in Indonesia.

RESULT AND DISCUSSION

Exploring Global Trends in Professional Military Education: Factors Driving Success in Different Nations

The PME approach applied is tailored to the defence needs of each country. PME in the United States is designed to develop strategic thinking and multi-domain operational capabilities that significantly contribute to strengthening the Air Force (Davis & Donnini, 1991). The application of PME in China emphasizes the integration of modern technology and the development of military doctrine that encourages a quantum leap in the capabilities of air force officers (Heaton Jr, 1980; Kamphausen et al., 2008; Kania & Costello, 2021). Singapore and Australia also utilise PME to strengthen regional collaboration, cross-operations, and cross-ships that support their officers in multinational roles (Australian Government Defence, 2024; Paget, 2016). European countries focus on cross-national operations within NATO and ethical decision-making to prepare officers for global security dynamics (Australian Government Defence, 2024; Paget, 2016). addition, collaboration between two countries in PME programmes also enriches the improvement of PME quality; one example is the collaboration between Indonesia and the United States through training programmes such as the International Military Education and Training (IMET) (Bitzinger et al., 2011). This overall approach shows that effective and well-planned PME not only builds strategic leadership but also ensures optimal operational readiness. The lessons learned from these countries are that PME can be a valuable tool for military officers to address evolving security challenges.

PME has been implemented differently in various countries, each with objectives and approaches tailored to their specific needs. In the United States, PME focuses on developing military leaders who possess the ability to think critically and strategically. Programmes such as Joint Professional Military Education (JPME) are designed to prepare officers for joint and multinational operations, emphasizing the importance of inter-service collaboration and a deep understanding of military (Cucolo & Betros, 2014; Ellinger & Posard, 2023). According to a report by the Government Accountability Office (GAO), the JPME programme is accredited to ensure high-quality education and relevance to the operational needs of the US military (Kelley & Johnson-Freese, 2014). On the other hand, countries such as the United Kingdom and Australia have adopted a more integrated PME model, where military education is part of an officer's career path from the outset. This approach aims to develop officers who not only possess technical skills but also have a deep understanding of military theory and practice. PME as an institution in shaping military professionalism highlights the role of education in building officer competence and ethics (Sheringham, 2022; Syme-Taylor & Jalili, 2018).

Meanwhile, several developing countries have collaborated with countries such as the United States to improve the quality of their PME (Asdar & Nurdin, 2024; Stolberg et al., 2018). For example, the Indonesian Air Force has established a strategic collaboration with the US government in the Professional Military Education and Training (PMET) program at Depohar 10, which aims to improve the capabilities of calibration laboratories and the maintenance of precision measuring instruments (Koharmatau, 2025). This collaboration highlights the significance of knowledge and technology exchange in enhancing the quality of military education

in partner countries. This comparison shows that although the basic objectives of PME are similar, namely to develop competent and professional officers, the approach and implementation may differ according to the context and needs of each country. Therefore, it is essential for each country to tailor its PME model to meet the challenges and dynamics of its strategic environment.

Indonesia has a tiered and integrated education system that encompasses the formation, development, and strengthening of the professionalism of TNI soldiers and officers in three branches, including the Army, Navy, and Air Force (Tentara Nasional Indonesia, 2008) which is substantially in line with PME, although to date the term PME is not used explicitly in official documents or academic literature. These three branches have a structured and tiered education system, comprising officer, non-commissioned officer, and enlisted personnel education, each with different patterns and types (Tentara Nasional Indonesia, 2008). The education system within the Indonesian Armed Forces comprises distinct levels based on rank, including Enlisted Personnel, Non-Commissioned Officers, and Commissioned Officers, which apply to the three branches of the Defence Force of Indonesia: the Army (TNI AD), Navy (TNI AL), and Air Force (TNI AU). However, in practice, these education levels are adjusted to the needs, characteristics, and specialisations of each branch. Enlisted personnel consist of soldiers such as Private Second Class, Private First Class, and Sergeant. Enlisted personnel are the primary executors in the field, focusing on the implementation of daily operational tasks, and are crucial as the spearhead of national defense. Enlisted personnel education emphasises the cultivation of mental attitude, physical endurance, basic military technical skills, and knowledge appropriate for the implementation of tasks in the field. After completing their initial training, enlisted personnel can pursue specialised development training to acquire additional expertise or proficiency in specific fields as required by the TNI organisation. This training aims to develop mastery of operational technical aspects and empower enlisted personnel as frontline implementers of the TNI's operational tasks (Tentara Nasional Indonesia, 2008).

The concept of Professional Military Education (PME) is a military education structure designed in a gradual and systematic manner to develop soldiers with the competencies, professionalism, and leadership capacity required in the contemporary era. Internationally, the PME concept has been adopted in various countries, including the United States, the United Kingdom, Australia, and NATO countries, each with similar educational structures and stages but with different terminology and emphases. For example, in the United States, PME includes educational programmes at six levels, ranging from "Entry Level" at military academies such as the US Military Academy West Point, "Intermediate Level Education" such as the Command and General Staff College, to "Senior Level Education" such as War Colleges such as the US Army War College (Joint Staff, 2024). Each level is designed to build basic, intermediate, and strategic competencies, with a curriculum that emphasises military expertise, morals, ethics, strategic analysis, leadership development, and strategic research.

The implementation of PME in Australia has also been adapted to suit local needs. PME in Australia has a military professional development process that spans one's entire career, beginning with basic education (pre-commissioning at the Australian Defence Force Academy/ADFA), progressing to the intermediate level (Australian Command and Staff College/ACSC), and culminating in the senior level (Centre for Defence and Strategic Studies/CDSS). The Australian PME level structure is designed to develop four main qualities, namely intellect, expertise, ethos, and leadership. Each level focuses on the developmental needs of military personnel and the demands of an increasingly complex operational context. Education at ADFA forms the basis of academics, ethics, and leadership, while ACSC and CDSS are oriented towards deepening strategy, management, and joint operations across three services (tri-service/joint PME) (Smith & Bergin, 2012).

Both concepts of PME implementation align with the TNI's tiered education system, which features a layered curriculum (basic, formation, general, and specialised development, and strategic education) and an orientation towards professional development, leadership, technical competence, and validation of learning outcomes. The Armed Forces Staff College and the TNI Staff College are institutions similar to "War Colleges" where mid-level and senior officers receive strategic education and national-level operational management training equivalent to Senior PME at the US Army War College and the British Defence Academy. In Indonesia, initial education is conducted at the respective TNI Academies, which function similarly to "Entry Level PME" at West Point, Sandhurst, or Duntroon in Australia. After that, the process of developing expertise continues throughout one's career, through job training, managerial training, and staff and command schools.

Referring to institutional literature and international documents, the main characteristics of PME are increasingly advanced curriculum levels, integration with the national education environment, professional development through education and training, and alignment of competencies with geopolitical and technological demands. All of these elements have been implemented in the TNI education programme. In the United Kingdom, for example, the Defence Studies programme has been translated into strategic research development, while in the TNI, innovation in science and technology education and defence management has become part of the officer development curriculum and demonstrates the level of adaptation to the global concept of PME.

Regarding terminology, in Indonesia, tiered education programmes within the TNI are not explicitly referred to as PME, but rather as "the TNI soldier education system," "formation/development education," "staff and command education," and "vocational education." This is a consequence of the unpopularity of the term PME in Indonesian military doctrine, as well as the dominance of national terms and frameworks, such as "TNI Soldier Education Development," "Military Academy Education," and "Sesko Education," among others. This difference in terminology is also inseparable from historical and national doctrine factors. Since

the revolutionary period, Indonesian military education has been designed to address practical needs, such as combat skills, discipline, and loyalty. This pragmatic orientation has led to the development of education that emphasises operational effectiveness rather than formal conceptualisation. Although its substance is very parallel and integral to international PME principles, the terminological approach in Indonesia focuses more on referring to the functions and strata of education according to the branch. This education system is generalised and applies to all branches with patterns and processes that refer to the same framework, objectives, and targets as PME in other countries.

The form of PME is generally clearly outlined in three dimensions; however, the institutional role of Seskoad as a staff and command institution is indeed more prominent and dominant than Seskoal (Navy) and Seskoau (Air Force). Since 1951, Seskoad has functioned as a centre for education, strategic studies, and the development of national-level military doctrine and leadership, with its alumni occupying important positions in the Defence Force of Indonesia (TNI) and government (Alwan Rachman, 2020). Its influence extends to the formulation of strategic defence policies and the management of officer human resources, placing Seskoad on par with the Command & General Staff College in the United States, which focuses on leadership, doctrine development, strategic research, and the development of analytical capabilities for mid- to senior-level officers (Alwan Rachman, 2020).

Meanwhile, Seskoal and Seskoau are more focused on professional development and internal modernisation of the armed forces, but their doctrinal activities and networks are still under the historical and institutional dominance of Seskoad. These two institutions have not yet fully adopted the aspects of strategic policy research, cross-disciplinary seminars, and national institutional influence. The actualisation of human resource development and the Seskoau curriculum still tends to focus on the main tasks of the organisation and is not yet fully optimal in terms of curriculum innovation, policy research, and strategic leadership like Seskoad. Although updates are carried out periodically, the influence and scale of curriculum development and doctrinal networks are not as significant and intensive as those of Seskoad, which was designed from the outset to lead and carry out integrated and cross-sectoral reforms of national military doctrine.

This condition is increasingly evident in the Indonesian Air Force, particularly in the structure and implementation of officer education, which is still oriented towards the PME concept and faces various limitations. The implementation of Professional Military Education (PME) in Indonesia, particularly within the Indonesian Air Force, is not yet fully structured and transparent (Tubantoro, 2018). The PME concept has not been explicitly adopted in the TNI AU's doctrine and policies as a whole. This has led to a vague and inconsistent understanding of PME among TNI AU personnel. Shortcomings in the implementation of PME can have a negative impact on the professional development of TNI AU officers (Armawi & Wahidin, 2019; Dzikri, 2016; Gindarsah & Priamarizki, 2021). Educational programmes that are not fully structured, transparent, and

standardised can result in officers lacking a deep understanding of the latest strategies, tactics, and technologies needed to face modern operational challenges. To enhance the strength of the Indonesian Air Force, it is necessary to adopt and implement PME in a clearer and more structured manner. This will ensure that officers possess the necessary knowledge and skills to address modern operational challenges, thereby enhancing the professionalism and effectiveness of the Indonesian Air Force as a whole.

The implementation of PME within the Indonesian Air Force has great potential to enhance air power, particularly through the development of superior and strategic human resources, especially among officers (Tentara Nasional Indonesia, 2008). Optimisation of PME within the Indonesian Air Force is facilitated by opportunities for further education both domestically and abroad. This programme is supported by scholarship funding from the State Budget, the Adi Upaya Foundation, and international programmes such as Fulbright and LPDP (LPDP, 2022) influencing the optimisation of PME in the Indonesian Air Force include adequate budgeting, the vision of the Indonesian Air Force leadership to become a respected air force in the region, and global competition in military force development (McFetridge, 1989; Soleh et al., 2019). Through this approach, it is hoped that PME can strengthen the capabilities of officers in supporting military operations and developing the strategic capabilities of the Indonesian Air Force.

This study utilized five main factors: curriculum, teaching staff, teaching methods, quality control, and research, in the implementation of PME at Sekkau and Seskoau TNI AU. The curriculum encompasses various fields, including strategy, technology, and leadership, to meet the operational needs of student officers (Kodiklatau, 2017). Several literature sources support the view that the curriculum is a crucial factor in PME (Goode, 2019a; Snider et al., 2001; Syme-Taylor & Jalili, 2018). The curriculum is used to determine the direction and substance of the competencies to be achieved in order to meet the needs and challenges of the modern military. Without proper curriculum design, learning will not be relevant or measurable in adapted conditions. Additionally, relevant teaching methods can enhance learners' understanding. Teaching methods developed with an interactive approach not only encourage active participation and engagement among learners, but also provide space to tailor learning to individual needs through open discussion and experience-based learning (Barreiros dos Santos et al., 2019; Powell & Townley, 2025).

Teaching staff are also a crucial factor that needs to be considered, as they act as catalysts for knowledge transfer and character development. Research in education has consistently shown that the quality of teachers/lecturers is a significant factor in determining learning outcomes, particularly in character education, such as military education. Military teachers (Tandik) act as role models and key drivers in the successful formation of character and have a positive influence in shaping the attitudes, behaviour, knowledge, skills, and leadership values of cadets, so that the quality and commitment of teachers are crucial to the success of students in achieving military

education goals (Bokiyar, 2016; Hanla, 2023; Yanto et al., 2022). Professional teaching staff with coaching abilities also support student character development (Doorn, 2019; Holth, 2008).

Quality assurance plays a crucial role in ensuring the quality of education through continuous evaluation, and research supports innovation and academic development in higher education (Mabesau, 2020, 2021). Quality assurance ensures that all educational processes and outputs comply with institutional standards and objectives, thereby guaranteeing the professionalism, ethics, and operational readiness of officers. The Indonesian Military Academy study stipulates that internal quality assurance is carried out independently and continuously through the PPEPP (Determination, Implementation, Evaluation, Control, and Improvement) cycle. The quality evaluation and audit process is carried out periodically to ensure that all educational activities are conducted in accordance with standards and strategic needs, and are adaptable to scientific developments (Wijaya, 2021). A Total Quality Management-based quality assurance system is crucial to ensure the achievement of educational objectives, academic development, and innovation relevant to future military needs (Wu et al., 2024).

Meanwhile, research on education implementation serves not only as continuous control and evaluation, but also as a source of innovation and evidence-based improvement, enabling the PME system to continue adapting to changes in the strategic environment and technological advancements of the time. The combination of these five factors forms a scientifically robust, practically tested, and critical military education ecosystem in facing the demands of modern-day tasks. These five factors depend on strategic planning and policy support from the Indonesian Air Force Headquarters, including adequate budget allocation. Effective PME management is capable of producing quality human resources that support the strength and sustainability of the Indonesian Air Force organisation.

Application of P.H. Coombs' Theory to Assess PME in the Indonesian Air Force: A Quantitative Approach

With the passage of time, PME has become a crucial issue for Indonesia's defence. Emerging issues include civil-military relations, military professionalism, and interoperability. The professionalism of the Indonesian National Armed Forces (TNI) is often understood narrowly, encompassing only political neutrality, whereas the public's demands on the TNI are broader, encompassing the TNI's role in national defense and security (Sebastian & Gindarsah, 2013). The issue of civil-military relations is also highly relevant, as professional military education plays a crucial role in maintaining neutrality and fostering cooperation between the military and civilians (Nix, 2012). In addition, interoperability between countries in multinational operations is a challenge that can be overcome with more transparent and standardised military education, which will strengthen the TNI AU's ability to face global challenges. Countries benefit from PME through the development of military leadership that is knowledgeable, has reliable strategies, and is able to respond effectively to global challenges and protect national interests (Beaulieu, 2012). PME

fosters intellectual growth and leadership excellence that strengthen a nation's defense capabilities and ensure the agility and resilience of its military forces in an interconnected and dynamic security environment (Oakley & Obadal, 2024).

The need for effective PME in Indonesia, particularly within the Indonesian Air Force, is becoming increasingly urgent in response to ever-evolving global challenges. PME must be adapted to the times and the challenges faced in missions. As part of the reform, PME is expected to produce officers who are not only professional but also understand the dynamics of civil-military relations and enhance interoperability in various military operations. Reforming the TNI AU's PME system is crucial to ensuring the readiness and quality of officers in facing increasingly complex threats in the future.

Based on the results of data collection through questionnaires that have been tested for validity and reliability to ensure that the research instruments can produce accurate and consistent data. The validity test ensures that the questionnaire is capable of measuring (Kimberlin & Winterstein, 2008; Taherdoost, 2016; Taylor, 2013). The testing criteria for validity are that if the significance value is < 0.05, then the item is valid (Field, 2018). The validity test results, as analyzed through SPSS, indicate that all question items for both independent and dependent variables have a p-value of 0.000, confirming their validity. Reliability refers to the consistency of measurement results when repeated under the same conditions, ensuring that the research instrument provides consistent results over time and is not influenced by unwanted external factors (Taherdoost, 2016). The reliability test was conducted using Cronbach's Alpha, with a criterion value of > 0.70 as an indicator of consistent data (Taber, 2018). Based on the results, all Cronbach's Alpha values were above 0.70, indicating that the research instrument was reliable for further analysis.

Before conducting multiple linear regression testing, there are classical assumption tests that must be fulfilled, namely tests for multicollinearity, normality, and heteroscedasticity. The multicollinearity test aims to determine whether the regression model reveals a correlation between independent variables or free variables (Ibdayanti et al., 2024; Wondola et al., 2020). The effect of multicollinearity is to cause high correlations among the variables in the sample. This means that the standard error is large, so that when the coefficient is tested, the t-count will be smaller than the t-value in the table. The testing criteria in this test are if the Tolerance value is > 0.100 and VIF is < 10.00, then it can be concluded that there is no symptom of multicollinearity (Shrestha, 2020; Yoo et al., 2014). Based on the output generated, all independent variables have a Tolerance value greater than 0.01 and a VIF value less than 10, indicating that the model does not exhibit multicollinearity. The normality test aims to ensure that the data are normally distributed, as one of the basic assumptions in multiple regression, so that the analysis results are valid and reliable (Schmidt & Finan, 2018). The normality test was conducted using P-Plot, Histogram, and variance coefficient calculations (Das & Imon, 2016; Mishra et al., 2019). The P-Plot graph shows that the data distribution follows a diagonal line. Meanwhile, the histogram is symmetrical and bell-shaped, which indicates a normal distribution. The calculation of variance

coefficients in normality tests is used to reduce subjective decision-making (Ran et al., 2021). The calculation of variance coefficients using mean and standard deviation values (Schillaci & Schillaci, 2022). Furthermore, the calculation of the coefficient of variance for all variables shows a value below 30%, reinforcing the conclusion that the data is normally distributed. Finally, a heteroscedasticity test was conducted to ensure that there were no changing patterns in the residual variance as the predictor values changed, thus fulfilling this assumption ((Rosopa et al., 2013). The test was conducted by observing the pattern in the scatterplot, which showed that the data distribution did not form a clear pattern and was scattered above and below 0 (Saputra & Fajri, 2020). Therefore, it can be concluded that there were no signs of heteroscedasticity, and the test assumption was fulfilled.

Furthermore, based on the testing criteria, if the significance value is < 0.05, then the independent variables simultaneously have a significant effect on the dependent variables (O'brien, 2007; White et al., 2022). The ANOVA output results show a significance value of < 0.001, so it can be concluded that the independent variables, namely research, curriculum, teaching staff, quality control, and teaching methods, simultaneously have a significant effect on the dependent variable. Meanwhile, the influence of each variable is partially known through hypothesis testing using the Output Coefficient. Based on the testing criteria, if the significance value is < 0.05, then the independent variable has a significant effect on the dependent variable. The hypothesis test results show that the curriculum (X1), teaching methods (X3), and quality control (X4) in PME has a significant effect on the development and advancement of air force strength, with significance values of 0.000 < 0.05, respectively. However, teaching staff (X2) and research (X5) do not have a significant effect, with significance values of 0.760 > 0.05 and 0.997 > 0.05, respectively. Thus, the curriculum, teaching methods, and quality control in PME play a crucial role in the development and advancement of air power, whereas teaching staff and research do not appear to have any significant effect.

This test produced the following regression equation (1):

$$Y = 14.673 + 0.892X1 + 0.823X3 + 0.718X4 \quad (1)$$

The regression equation above describes the relationship between air force strength (Y) and three independent variables, namely curriculum (X1), teaching methods (X3), and quality control (X4). The constant value of 14.673 indicates that if all three variables are equal to 0, air force strength will remain at 14.673. The regression coefficients for the variables of curriculum, teaching methods, and quality control indicate that a 1% increase in these variables will result in a 0.892, 0.823, and 0.718 increase in air force strength, respectively. Overall, this regression equation indicates that these three variables have a significant contribution to increasing the strength of the air force, with the curriculum having the greatest influence among the three.

Based on the Adjusted R Square value of 0.796, it can be seen that the variables of curriculum, teaching staff, teaching methods, quality control, and research in PME collectively have a 79.6% influence on the development and strengthening of air force capabilities, while the remaining 20.4% is influenced by other variables outside the scope of this study. Finally, it can be concluded that the curriculum, teaching methods, and quality control have a significant partial influence on the development and strengthening of the air force capabilities of Indonesian Air Force officers. These three elements directly contribute to shaping the abilities and readiness of officers in facing various challenges in the field. Meanwhile, teaching staff and researchers have no influence, indicating that although these two factors are important, they may not have a strong enough direct influence on the development of air force capabilities in the Indonesian Air Force at this time. This may also indicate that these two variables receive more criticism than other variables in the implementation of officer PME in the Indonesian Air Force.

Assessing the Contribution of PME to Air Force Strength: Regression Findings from Indonesian Air Force Officers (2019-2024)

Professional Military Education (PME) serves as a fundamental strategic instrument for cultivating the intellectual agility, critical thinking, and leadership required to navigate the volatile dynamics of modern security environments (H. H. Bell & Reigeluth, 2014; Ellinger & Posard, 2023; Sheringham, 2022). In the context of the Indonesian National Armed Forces (TNI), the success of such education depends on a structured and relevant framework tailored to the unique characteristics and operational challenges of each branch, including the Army, Navy, and Air Force, to ensure officers possess competencies aligned with modern defense roles. Despite ongoing efforts to enhance Indonesia's air power, the TNI AU faces significant hurdles that necessitate more intensive and targeted human resource development to counter modern asymmetric threats effectively(Armawi & Wahidin, 2019; Headquarters, 2024). Consequently, it is imperative to move beyond normative legal mandates toward empirical evidence to identify which educational factors most directly drive organizational success.

The data analysis in this study examines the relationship and contribution of various PME factors in improving the competence of Indonesian Air Force officers. The results of this study not only identify key elements that have a positive impact, but also reveal challenges that need to be overcome so that PME can optimally support national air defence tasks. The interpretation of the data analysis, field findings, and their implications is expected to provide input for the formulation of military education development policies that are more adaptive and relevant to the future operational needs of the Indonesian Air Force.

The selection of PME indicators in this study was based on P.H. Coombs' theory of education, as PME TNI AU incorporates Coombs' educational components. Five main factors were selected from the 10 components of TNI AU Education, namely curriculum, teaching staff, teaching methods, quality control, and research. The curriculum was selected due to its role in determining

the relevance of the material to the organisation's needs, while the teaching staff are key to ensuring the quality of teaching. Teaching methods were measured based on their effectiveness in creating an interactive learning environment. Quality control involved both internal and external evaluations of educational implementation, ensuring that every process complied with established standards. Research, as the final indicator, focused on the contribution of PME in producing innovations or problem-solving that supported the tasks of the Indonesian Air Force (Coombs, 1970; Mabesau, 2020).

Statistical calculations using IBM SPSS Statistics indicate that the curriculum, teaching methods, and quality control have a significant impact on the process of building and developing air force capabilities within the Indonesian Air Force. These three elements play an important role in shaping the capabilities and readiness of Indonesian Air Force officers to face various challenges in the field. This means that improvements and enhancements in the curriculum, teaching methods, and quality control can directly improve the quality and strength of the air force. However, on the other hand, it is mentioned that teaching staff and researchers do not have a significant influence on the development of the Indonesian Air Force's air power. This means that although teaching staff and research activities are considered important in the context of education, they may not have a sufficiently strong direct impact on improving the strength of the Indonesian Air Force at this time. Overall, this paper emphasizes that the main focus in improving the strength of the Indonesian Air Force should be directed at improving the curriculum, teaching methods, and quality control, while other factors, such as teaching staff and research, although important, may require a different approach to have a more tangible impact.

A well-designed PME curriculum serves as the foundation for Air Force operational readiness, ensuring that personnel acquire the technical and strategic competencies required for modern warfare (Pearse, 2009). This study aligns with and updates the research conducted by Marsono, (2004), which revealed that the learning curriculum has a positive influence on the performance of Defence Force of Indonesia Command soldiers. The PME curriculum, which emphasises joint operations, advanced technology integration, and adaptive leadership, prepares officers to face multi-domain challenges. These elements play an important role in shaping air force personnel who are ready to carry out missions and capable of navigating complex operational landscapes (Ellis, 2020). Improvements in the curriculum can directly enhance the quality and strength of the air force. This is because the military education curriculum occupies a fundamental position, where the expected competency achievements can be formed from teaching materials tailored to the curriculum used (Novita et al., 2024). The evaluation of the curriculum used needs to be carried out continuously to ensure it remains relevant to changing conditions. Research by DuPerier (1999), which evaluated the PME curriculum in the United States Air Force (USAF) after the Vietnam War, revealed that a curriculum based on reflection and critical learning made USAF officers more adaptive, critical, able to analyse the complexity of air operations, and ready to provide advice to policy-makers.

Modern teaching methods at PME utilize innovative pedagogical approaches to maximize learning outcomes and adaptability (Noble, 2017). The role of blended learning models that combine virtual simulations and active learning strategies, such as war games, with AI-supported adaptive platforms makes learning more dynamic, while also encouraging collaboration and critical thinking (Antrobus & West, 2022; Williams, 2013). A comprehensive and modern training environment for officer personnel can help simulate combat scenarios without risk, significantly improving operational readiness (Johnson, n.d.; Trewin et al., 2010). Modern teaching methods in PME now emphasise active and interactive learning strategies, such as the integration of virtual simulations, war games, and adaptive digital platforms. This approach makes the learning process more relevant and flexible, allowing officers to engage directly in problem-solving, team collaboration, and response exercises to real-world scenarios. Such learning models have been proven to enhance critical thinking skills and operational readiness in military environments.

Strict quality control measures in the Indonesian Air Force's PME program are crucial in ensuring the program's effectiveness. An effective evaluation mechanism can be implemented through performance audits and accreditation standards (Farrell, 2020; Goode, 2019a). This is done to ensure alignment with the strategic objectives and operational requirements of the PME programme. Another form of quality control is the continuous development of instructors to ensure that PME remains relevant and impactful in line with current needs (Barreiros dos Santos et al., 2019; Goode, 2019a; Terziev & Madanski, 2017). Additionally, suggestions from graduates are utilized to refine the course structure and delivery methods. The implementation of multi-stakeholder engagement-based quality control, internal and external evaluation, and a continuous improvement cycle not only ensures compliance with standards and operational requirements but also accelerates learning innovation, adaptation of best practices, and transparency and accountability of military educational institutions (Dublin, 2018; Headquarters, 2024; Atlantic Technological University, 2025). Therefore, to strengthen the development and enhancement of air power, the Indonesian Air Force must continue to focus on improving the quality of the curriculum, teaching methods, and quality control, while also paying attention to other aspects that can strengthen the overall military education system and improve its quality.

Teaching staff and researchers did not show a statistically significant influence, but this does not mean that they do not have an important role in the long term. Future improvements in the quality of teaching staff and increased integration of research results into the curriculum and teaching methods could be factors that strengthen the quality of PME (Barreiros dos Santos et al., 2019; Bestiuk, 2024; Widjayanto & Priyanto, 2023). Based on the findings from the respondents' statements through questionnaires on these two factors, several important criticisms emerged regarding the quality of teaching staff and the limited scientific writing and research activities in the curriculum. This indicates dissatisfaction with these two aspects, although statistically, it has no effect in the context of PME in Indonesia. The stagnation of competencies and the lack of adaptation to technological developments and modern operational demands pose a unique

challenge in determining teaching staff. Anondo (2022), states that at the Air Force Academy (AAU) itself, the management of teaching staff still faces a number of obstacles, such as the suboptimal regeneration of teaching staff, where officials who hold PPM positions are sometimes not NIDN lecturers, which is not in line with the needs of military higher education organisations. This condition also affects research, which ultimately requires challenges in its development. The management of teaching staff and research activities requires a more systematic approach so that their existence can truly be in harmony and contribute significantly to the vision and mission of the Indonesian Air Force in developing air power, not merely as administrative or academic support.

These two factors are related to the conditions and limitations that exist in the development of military education in the Indonesian Air Force. One of the causes is the lack of specialised training for teaching staff and facilities that support relevant scientific research. Therefore, neither factor has a significant influence in the context of statistics in the Indonesian Air Force's PME; however, this yields different results when applied to other air forces that have a higher quality of teaching staff and research facilities. More competent teaching staff and a more in-depth research system have a significant impact on the development of air power, both in terms of enhancing the quality of education and contributing to innovation and the advancement of military doctrine. Another factor is that the research standards formulated in military academies emphasise the importance of a culture of quality, but implementation in the field still faces challenges, such as a lack of research assistance, a lack of motivation for international publication, and inadequate research facilities. In addition, the stagnant competence of teaching staff has resulted in the transfer of knowledge that tends to be conventional and less relevant to technological developments and the challenges of modern warfare.

The research writing ecosystem at AAU has not been a top priority in the learning process. Therefore, even though there are scientific assignments such as Individual Papers given to Student Officers as part of the teaching and learning process during their education at the Air Force Command School (Sekkau), the substance of the research produced often only meets administrative requirements without making a real contribution to defence innovation or doctrine development. Not only that, multidimensional influences such as strategic policy and technological development, the availability and condition of facilities and infrastructure, and organisational and resource management can also be influential factors. Improvements to the curriculum, teaching methods, and quality control are systemic aspects that shape the overall educational framework. In other words, although teaching staff are the primary implementers, the success of quality improvement depends more on the existence of a strong and structured education system, because without good systemic support, the quality of teaching staff alone is insufficient to produce significant changes in air force capabilities.

The results of this study reveal a notable divergence from international PME models, where systemic factors like curriculum and quality control outweigh the direct impact of teaching staff

and research. In countries such as the United States and the United Kingdom, PME is deeply integrated into a career-long development process that emphasizes strategic research and a thinking soldier ethos, often supported by robust doctrinal networks and accredited quality assurance. In contrast, the non-significant impact of teaching staff and research in the Indonesian Air Force (TNI AU) can be attributed to structural and cultural barriers, including a stagnation of competencies and a research ecosystem that often prioritizes administrative compliance over genuine doctrinal innovation. This suggests that while the TNI AU has successfully mirrored the tiered structures of global models like those in Australia or NATO countries, the pragmatic orientation of Indonesian military education, rooted in historical combat effectiveness rather than formal conceptualization, limits the current influence of academic research on operational strength. Consequently, the lack of specialized training for educators and the absence of a research writing ecosystem that supports defense innovation remain distinct challenges for the TNI AU compared to its international counterparts

CONCLUSION

This study confirms that PME is a strategic instrument for TNI AU, with its curriculum, teaching methods, and quality control accounting for 79.6% of the progress in air power development. The curriculum stands as the most influential pillar in shaping officer competency for multi-domain operations. However, the lack of significant influence from teaching staff and research activities highlights a critical area for institutional reform, particularly regarding the need for specialized training for educators and the integration of research into doctrinal development. To strengthen strategic air power, the Indonesian Air Force must prioritize pedagogical innovation and robust quality assurance mechanisms. Future research should explore qualitative barriers to instructor professionalism and examine the 20.4% of external variables, such as budget and technology infrastructure, that also influence air power strength.

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