International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Challenges in Delivering Laboratory-Based Training in a Caap-Approved Training Organization

Jose Ramon G. Carrillo

National Aviation Academy of the Philippines, Pasay City, Philippines

Abstract

This study examined the challenges in delivering laboratory-based training at the University of Perpetual Help System Laguna–Biñan Campus, a CAAP-approved training organization. Specifically, it assessed perceived compliance with CAAP laboratory training standards, limitations in facilities and equipment, instructor-related factors, student-related factors, challenges affecting training effectiveness, and proposed improvement programs. The study employed a quantitative descriptive-comparative research design involving 50 respondents: three administrators, three laboratory instructors, and 44 Aircraft Maintenance Technology students. Data were collected through a researcher-developed questionnaire and analyzed using frequency, percentage, weighted mean, standard deviation, and the Kruskal–Wallis test. Results indicated that respondents generally perceived the institution as compliant with CAAP laboratory training standards. Instructor-related factors received a Strongly Agree assessment, while facilities and equipment limitations, student-related factors, and challenges affecting training effectiveness revealed areas requiring improvement. Limited funding, equipment shortages, large class sizes, and outdated equipment emerged as prominent concerns. The Kruskal–Wallis test showed no statistically significant difference in compliance assessments according to academic status ($H = 3.250$, $p = 0.355$). Respondents strongly supported continuous improvement programs, industry partnerships, and laboratory equipment upgrading. The study recommends strengthening institutional resources, instructor development, safety monitoring, and industry collaboration to enhance practical training delivery.

Keywords: aviation maintenance education; laboratory-based training; approved training organization; CAAP; technical education; training resources

I. Introduction

Aviation maintenance education plays a critical role in preparing future aircraft maintenance professionals to perform technical tasks that directly influence aircraft safety, operational reliability, and regulatory compliance. Unlike purely classroom-based instruction, aircraft maintenance education requires students to develop both theoretical understanding and practical competencies through laboratory exercises, equipment handling, inspection procedures, troubleshooting activities, and maintenance simulations. These learning experiences enable students to translate technical knowledge into appropriate maintenance practices and develop the precision, judgment, and safety awareness required in actual aviation environments. The International Civil Aviation Organization (ICAO, 2020)

emphasizes competency-based training and assessment as an approach to developing and evaluating the competencies required of aviation personnel, including aircraft maintenance professionals.

The growing emphasis on competency-based education highlights the importance of providing appropriate training environments, instructional resources, and performance-based assessment. In aircraft maintenance programs, laboratory facilities must provide students with opportunities to work with relevant tools, equipment, aircraft components, and instructional materials. These resources are not merely supplementary to classroom instruction; they form an essential part of practical competency development. In its manual on competency-based training and assessment for aircraft maintenance personnel, ICAO (2021) underscores the need to align training activities and assessment with the competencies required in the workplace. Consequently, the quality of laboratory-based instruction depends not only on the curriculum but also on the availability of facilities, the competence of instructors, and the preparedness and active participation of students.

Recent studies reinforce the importance of strengthening practical training in aircraft maintenance education. Ramoso and Ortega-Dela Cruz (2025), in their study of Aircraft Maintenance Technology students in the Philippines, found that co-curricular activities, seminars, workshops, and on-the-job training were perceived as influential contributors to students' readiness for the aviation industry. Their findings also highlighted the importance of training facilities and the integration of hands-on experiences into academic programs. Similarly, Dela Peña et al. (2025), in an investigation of competency gaps in Philippine aviation maintenance education, identified deficiencies in advanced diagnostics, avionics systems, composite materials, and essential soft skills, including communication and teamwork. The researchers emphasized the need to expand practical training, strengthen industry-academic partnerships, and improve the alignment of curricula with international aviation standards.

The changing technological landscape of aviation further increases the demands placed on educational and training institutions. Chavan et al. (2025) examined the emerging technologies and workforce requirements affecting aviation maintenance education. Their qualitative study involving educators, industry professionals, and regulatory stakeholders identified limited resources, inadequate access to updated training equipment, and delays in curriculum modernization as barriers to preparing students for emerging aircraft technologies. The study emphasized the importance of providing relevant equipment and strengthening collaboration between educational institutions and the aviation industry. These findings suggest that the adequacy and modernization of laboratory facilities are important considerations in maintaining the relevance of aircraft maintenance training.

In addition to facilities and equipment, instructor competence is a major consideration in the delivery of effective laboratory-based training. Instructors are responsible for translating technical concepts into practical learning experiences, demonstrating appropriate maintenance procedures, supervising students during laboratory activities, and evaluating their performance against established competencies. Kes et al. (2025), in their study on the assessment of transversal competencies in aircraft maintenance, emphasized the importance of instructor training, assessment calibration, and clearly defined performance rubrics. Their findings suggest that instructors require not only technical expertise but also the capacity to assess and develop students' communication, teamwork, and other non-technical competencies. In a related study, Dela Peña et al. (2025) proposed an instructional framework integrating outcome-based education, competency-based training and assessment, and experiential learning. Their findings identified the need for sustained faculty development and improved performance-based assessment in Aircraft Maintenance Technology programs.

Student-related factors also influence the effectiveness of laboratory instruction. Students' academic preparation, technical knowledge, motivation, participation, and opportunities for hands-on practice may affect their ability to acquire and demonstrate practical competencies. Ramoso and Ortega-Dela Cruz (2025) highlighted the contribution of co-curricular activities and industry exposure to students' readiness for aviation employment. Meanwhile, the importance of developing technical and non-technical competencies is further supported by Kes et al. (2026), who examined the assessment of transversal competencies in aircraft maintenance education. Their Delphi study involving international aircraft maintenance experts identified communication, teamwork, and work management as important competencies that require clearer performance-based assessment criteria.

The importance of laboratory-based training is also reflected in research examining the actual implementation of aircraft maintenance activities in educational settings. Dela Peña (2024), in a study on optimizing preventive maintenance procedures for aircraft systems in an educational laboratory, emphasized the need to improve resource management and laboratory practices to support student learning. More recently, Kes et al. (2026) examined the development of valid assessment criteria for transversal competencies in aircraft maintenance education. Their findings demonstrated the need for standardized performance expectations and assessment procedures to ensure that students develop competencies relevant to professional practice. These studies collectively demonstrate that effective aircraft maintenance education requires the integration of appropriate learning resources, structured practical activities, and systematic competency assessment.

Despite the growing body of literature on competency-based aviation education, student readiness, curriculum alignment, and the development of technical competencies, challenges in the actual delivery of laboratory-based training remain an important area for further investigation. Existing Philippine studies have primarily examined competency gaps, student preparedness, curriculum implementation, and instructional frameworks. International studies have likewise explored competency assessment, emerging technologies, and the professional competencies required of aircraft maintenance personnel. However, these studies do not fully explain how institutional conditions, laboratory resources, instructor-related factors, and student-related factors collectively influence the delivery of laboratory-based instruction within a specific CAAP-approved training organization.

Recent research also indicates that challenges in aviation maintenance education are not limited to curriculum design. Chavan et al. (2025) identified limited training resources and insufficient access to updated equipment as barriers to curriculum modernization, while Kes et al. (2025) emphasized the need for instructor development and consistent competency assessment. In the Philippine context, Dela Peña et al. (2025) identified gaps between existing educational preparation and industry competency requirements. Nevertheless, further institution-level investigation is necessary to understand how these concerns are experienced by administrators, instructors, and students within the same training environment.

In the Philippines, the Civil Aviation Authority of the Philippines (CAAP) establishes regulatory requirements for organizations providing aviation training through the Philippine Civil Aviation Regulations (PCAR), particularly Part 3, which governs Approved Training Organizations. These requirements provide the regulatory context for ensuring that training organizations maintain appropriate instructional arrangements and training standards. However, regulatory approval alone does not necessarily explain the day-to-day challenges encountered in delivering laboratory-based instruction. Institutional capacity, equipment availability, maintenance of laboratory resources, instructor

qualifications, student preparedness, and the implementation of training activities remain important considerations in examining the effectiveness of practical training delivery. The distinction between regulatory requirements and stakeholders' perceptions of their implementation is particularly important: perceived compliance should not automatically be interpreted as independently verified regulatory compliance.

To address this research gap, the present study examines the challenges in delivering laboratory-based training in a CAAP-approved training organization, particularly at the University of Perpetual Help System Laguna–Biñan Campus. Specifically, it investigates respondents' assessments of the organization's compliance with applicable CAAP laboratory training standards and examines the perceived influence of limited facilities and equipment, instructor-related factors, and student-related factors on laboratory instruction. It also identifies the challenges encountered in the delivery of practical training, determines whether assessments of compliance significantly differ according to respondents' academic status, and explores possible plans and programs to enhance laboratory-based training.

By considering the perspectives of administrators, instructors, and students, this study seeks to provide an institution-level understanding of the conditions affecting laboratory-based training in an aviation education setting. Its findings may serve as a basis for identifying areas requiring improvement, strengthening laboratory resources, supporting instructor development, and enhancing students' practical learning experiences. Ultimately, the study aims to contribute to the continuous improvement of laboratory-based instruction and the delivery of quality aviation maintenance education within a CAAP-approved training organization.

II. Methods

This study employed a quantitative descriptive-comparative research design to examine the challenges in delivering laboratory-based training at the University of Perpetual Help System Laguna–Biñan Campus, a CAAP-approved training organization. The descriptive component determined respondents' assessments of compliance with CAAP laboratory training standards, limitations in facilities and equipment, instructor-related factors, student-related factors, and challenges affecting laboratory training effectiveness. It also identified proposed plans and programs to enhance laboratory-based training. The study involved 50 respondents, consisting of three administrators, three laboratory instructors, and 44 Aircraft Maintenance Technology students with relevant laboratory training experience. Data were collected using a researcher-developed questionnaire, which was subjected to expert validation by three aviation training professionals to assess its clarity, relevance, and alignment with the research objectives and applicable CAAP requirements.

Data were collected through Google Forms and analyzed using appropriate statistical techniques. Frequency and percentage were used to describe the respondents' demographic profiles, while weighted mean and standard deviation were employed to determine their assessments of the different dimensions of laboratory-based training using a four-point Likert scale. The Kruskal–Wallis test was used to determine whether significant differences existed in respondents' assessments of CAAP laboratory training compliance when grouped according to academic status. The results provided a quantitative basis for identifying institutional and instructional concerns and formulating proposed programs to improve the delivery of laboratory-based training.

III. RESULTS

1. Respondents' Demographic Profile

Table 1 Respondents Demographic Profile

Characteristic	Category	n	%
Age	20–29 years	46	92.0
	30–39 years	3	6.0
	40–49 years	1	2.0
Gender	Male	39	78.0
	Female	10	20.0
	Prefer not to say	1	2.0
Experience	1–5 years	44	88.0
	6–10 years	1	2.0
	11–15 years	3	6.0
	16 years or more	2	4.0
Academic status	Bachelor's degree	44	88.0
	With master's units	3	6.0
	Master's degree	2	4.0
	With doctoral units	1	2.0

Table 1 shows that most respondents (92%) were aged 20–29, while 78% were male. In terms of experience, the majority (88%) had 1–5 years of experience. Regarding academic status, 88% held a bachelor's degree, followed by 6% with master's units, 4% with a master's degree, and 2% with doctoral units. Overall, the respondents were predominantly young, male, and relatively early in their professional or academic experience, with most belonging to the bachelor's degree category.

2. Respondents Assessment on the Compliance of the University of Perpetual Help System Laguna – Biñan Campus with CAAP Laboratory Training Standards

Table 2 Respondents Assessment on the Compliance of the University of Perpetual Help System Laguna – Biñan Campus with CAAP Laboratory Training Standards

Indicators	Mean	Std. Deviation	Interpretation
1. The laboratory facilities comply with the required training standards of the CAAP.	3.24	0.59	Compliant
2. Laboratory equipment conforms to the specifications prescribed by the CAAP.	3.04	0.53	Compliant
3. The required number of laboratory hours is implemented in accordance with CAAP requirements.	3.10	0.76	Compliant
4. Laboratory activities adhere to the CAAP-approved training curriculum.	3.12	0.66	Compliant
5. Laboratory safety procedures are aligned with CAAP safety regulations.	3.06	0.63	Compliant

Indicators	Mean	Std. Deviation	Interpretation
6. Laboratory manuals are updated in accordance with CAAP standards.	3.18	0.75	Compliant
7. Student performance assessment follows the competency requirements set by the CAAP.	3.14	0.57	Compliant
8. Laboratory records and documentation are maintained in compliance with CAAP guidelines.	2.98	0.71	Compliant
9. Regular laboratory safety inspections are conducted in accordance with CAAP regulations.	3.14	0.70	Compliant
10. The institution regularly monitors compliance with CAAP laboratory training standards.	3.08	0.67	Compliant

Table 2 presents that respondents generally perceived the University of Perpetual Help System Laguna–Biñan Campus as compliant with CAAP laboratory training standards, as all indicators received mean scores interpreted as Compliant. Laboratory facilities obtained the highest mean (M = 3.24, SD = 0.59), indicating a favorable assessment of the adequacy and alignment of the facilities with the required training standards. This was followed by the updating of laboratory manuals (M = 3.18, SD = 0.75), while student performance assessment and regular laboratory safety inspections both obtained a mean of 3.14.

Meanwhile, the maintenance of laboratory records and documentation received the lowest mean (M = 2.98, SD = 0.71), followed by equipment conformity (M = 3.04, SD = 0.53). Although these indicators were still interpreted as compliant, they represent areas that may benefit from closer monitoring and improvement. Overall, the findings suggest that the institution demonstrates generally favorable compliance with CAAP laboratory training standards based on respondents' perceptions, while continued attention to documentation, equipment, and safety practices may further strengthen laboratory training implementation.

3. Respondents evaluation on the limitation of facilities and equipment that affects laboratory instruction

Table 3 Respondents' evaluation on the limitation of facilities and equipment that affects laboratory instruction

Indicators	Mean	Std. Deviation	Interpretation
1. The laboratory has sufficient tools for all students during sessions.	2.30	0.89	Disagree
2. The equipment used in the laboratory is in good working condition.	2.82	0.67	Agree
3. Laboratory equipment is modern and up to date.	2.78	0.76	Agree

Indicators	Mean	Std. Deviation	Interpretation
4. There is enough laboratory space to conduct activities safely.	2.20	0.95	Disagree
5. The laboratory environment supports effective hands-on training.	2.90	0.76	Agree
6. There are enough consumable materials for laboratory activities.	2.60	0.86	Agree
7. Equipment shortages affect the quality of laboratory instruction.	3.40	0.67	Strongly Agree
8. Delays in equipment repair affect laboratory schedules.	3.30	0.65	Strongly Agree
9. Budget limitations affect laboratory improvement.	3.48	0.58	Strongly Agree
10. The availability of tools supports student skill development.	3.32	0.62	Strongly Agree
General Weighted Mean	**2.91**	**0.42**	**Agree**

Table 3 presents the respondents' evaluation of the limitations in facilities and equipment affecting laboratory instruction, with a general weighted mean of 2.91 (SD = 0.42), interpreted as Agree. The highest-rated indicator was budget limitations affecting laboratory improvement (M = 3.48, SD = 0.58), followed by equipment shortages affecting the quality of laboratory instruction (M = 3.40, SD = 0.67). Delays in equipment repair (M = 3.30, SD = 0.65) and the availability of tools in supporting students' skill development (M = 3.32, SD = 0.62) were also strongly agreed upon by respondents. These findings suggest that financial constraints, equipment shortages, and maintenance delays are significant concerns affecting the delivery of laboratory-based training.

Meanwhile, respondents disagreed that sufficient tools were available for all students during laboratory sessions (M = 2.30, SD = 0.89) and that laboratory space was adequate for conducting activities safely (M = 2.20, SD = 0.95). Although the condition of existing equipment (M = 2.82, SD = 0.67), its modernization (M = 2.78, SD = 0.76), and the availability of consumable materials (M = 2.60, SD = 0.86) received favorable agreement, these areas may still require improvement. Overall, the findings indicate that limitations in laboratory resources, particularly the availability of tools, adequate space, funding, and equipment maintenance, remain important challenges that may affect students' opportunities for effective hands-on learning.

4. The assessment of the respondents on instructor-related factors influence the delivery of laboratory-based training

Table 4 Respondents Assessment on Instructor-Related Factors Influence the Delivery of Laboratory-Based Training

Indicators	Mean	Std. Deviation	Interpretation
1. Instructors demonstrate strong technical knowledge in laboratory subjects.	3.34	0.66	Strongly Agree
2. Instructors clearly explain laboratory objectives before activities.	3.44	0.54	Strongly Agree
3. Instructors provide step-by-step demonstrations of procedures.	3.24	0.69	Strongly Agree
4. Instructors strictly enforce safety rules in the laboratory.	3.38	0.57	Strongly Agree
5. Instructors provide immediate feedback during laboratory tasks.	3.12	0.69	Agree
6. Instructors attend training related to CAAP standards.	3.40	0.53	Strongly Agree
7. Instructor workload affects the quality of laboratory supervision.	3.20	0.67	Agree
8. Instructors prepare lesson plans for laboratory sessions.	3.24	0.62	Strongly Agree
9. Instructors effectively manage student behavior in the laboratory.	3.20	0.61	Agree
10. Instructor experience contributes to effective laboratory training.	3.30	0.61	Strongly Agree
General Weighted Mean	**3.29**	**0.47**	**Strongly Agree**

Table 4 presents the respondents' assessment of instructor-related factors influencing the delivery of laboratory-based training, with a general weighted mean of 3.29 (SD = 0.47), interpreted as Strongly Agree. The highest-rated indicator was the clear explanation of laboratory objectives before activities (M = 3.44, SD = 0.54), followed by instructors' attendance at training related to CAAP standards (M = 3.40, SD = 0.53) and strict enforcement of laboratory safety rules (M = 3.38, SD = 0.57). These findings indicate that instructors demonstrate strong instructional preparation, regulatory awareness, and commitment to laboratory safety.

Meanwhile, providing immediate feedback during laboratory tasks obtained the lowest mean (M = 3.12, SD = 0.69), followed by workload-related concerns affecting laboratory supervision (M = 3.20, SD = 0.67) and student behavior management (M = 3.20, SD = 0.61). Although these indicators were still rated favorably, they suggest opportunities to improve feedback practices, workload management, and

laboratory supervision. Overall, the findings highlight the positive contribution of instructors' technical knowledge, experience, preparation, and safety practices to effective laboratory-based training.

5. The assessment of the respondents on student-related factors affects laboratory-learning outcomes.

Table 5

Respondents Assessment on Student-Related Factors Affecting Laboratory-Learning Outcomes

Indicators	Mean	Std. Deviation	Interpretation
1. Students come prepared before laboratory sessions.	3.04	0.67	Agree
2. Students understand laboratory objectives before starting activities.	3.20	0.61	Agree
3. Students follow safety procedures at all times.	3.10	0.65	Agree
4. Students actively participate in hands-on activities.	3.18	0.60	Agree
5. Students demonstrate responsibility when using tools and equipment.	3.12	0.63	Agree
6. Students have adequate theoretical knowledge before laboratory work.	3.16	0.65	Agree
7. Student motivation affects laboratory performance.	3.48	0.54	Strongly Agree
8. Large class size affects student participation.	3.46	0.71	Strongly Agree
9. Students' complete laboratory tasks within the given time.	2.84	0.87	Agree
10. Students show professionalism during laboratory sessions.	3.16	0.68	Agree
General Weighted Mean	**3.17**	**0.44**	**Agree**

Table 5 shows the respondents' assessment of student-related factors affecting laboratory-learning outcomes, with a general weighted mean of 3.17 (SD = 0.44), interpreted as Agree. Student motivation obtained the highest mean (M = 3.48, SD = 0.54), followed by the influence of large class sizes on student participation (M = 3.46, SD = 0.71), both interpreted as Strongly Agree. These findings suggest that students' motivation and class size are important considerations in achieving effective laboratory learning experiences.

Meanwhile, completing laboratory tasks within the allotted time received the lowest mean (M = 2.84, SD = 0.87), although it was still interpreted as Agree. Students' preparedness before laboratory sessions (M = 3.04, SD = 0.67) and compliance with safety procedures (M = 3.10, SD = 0.65) also received relatively lower ratings. Overall, the findings indicate that while students generally demonstrate positive participation, preparedness, and responsibility, motivation, class size, and time management remain important factors that may influence the effectiveness of laboratory-based learning.

6. Challenges affecting laboratory training effectiveness

Table 6

Challenges Affecting Laboratory Training Effectiveness

Indicators	Mean	Std. Deviation	Interpretation
1. Limited funding affects the overall quality of laboratory training.	3.42	0.61	Strongly Agree
2. Outdated equipment reduces training effectiveness.	3.40	0.67	Strongly Agree
3. Insufficient laboratory time limits skill development.	3.30	0.71	Strongly Agree
4. Large student population affects supervision quality.	3.44	0.73	Strongly Agree
5. Lack of industry exposure affects practical competency.	3.32	0.59	Strongly Agree
6. Delays in equipment procurement affect laboratory delivery.	3.36	0.56	Strongly Agree
7. Limited instructor training affects laboratory instruction quality.	3.36	0.63	Strongly Agree
8. Weak monitoring of compliance affects laboratory standards.	3.24	0.69	Strongly Agree
9. Inadequate safety resources affect laboratory operations.	3.32	0.65	Strongly Agree
10. Institutional policies affect laboratory efficiency.	3.30	0.68	Strongly Agree
General Weighted Mean	**3.26**	**0.39**	**Strongly Agree**

Table 6 presents the challenges affecting laboratory training effectiveness, with a general weighted mean of 3.26 (SD = 0.39), interpreted as Strongly Agree. The highest-rated challenge was the effect of a large student population on supervision quality (M = 3.44, SD = 0.73), followed by limited funding (M = 3.42, SD = 0.61) and outdated equipment (M = 3.40, SD = 0.67). Delays in equipment procurement and limited instructor training both obtained a mean of 3.36, highlighting additional concerns affecting laboratory instruction.

Other challenges included insufficient industry exposure and inadequate safety resources (both M = 3.32), as well as insufficient laboratory time and institutional policies (both M = 3.30). Weak monitoring of compliance received the lowest mean (M = 3.24, SD = 0.69), although it was still interpreted as Strongly Agree. Overall, the findings indicate that laboratory training effectiveness is influenced by interconnected institutional, resource-related, instructional, and student-related challenges, particularly funding constraints, equipment limitations, and the need for adequate supervision.

7. Significant Difference in the Assessment of Respondents on the Compliance of the University of Perpetual Help System Laguna – Biñan Campus with CAAP Laboratory Training Standards

Table 7

Significant Difference in the Assessment of Respondents on the Compliance of the University of Perpetual Help System Laguna – Biñan Campus with CAAP Laboratory Training Standards

Indicators	Group	N	Mean Rank	H	df	p-value	Decision	Interpretation
Compliance with CAAP Laboratory Training Standards	Bachelor's Degree	44	25.07	3.250	3	0.355	Accept	Not Significant
	With Master's Units	3	29.17					
	Master's Degree	2	38.25					
	With Doctoral Units	1	8.00					

p>0.05

Table 7 presents the results of the Kruskal–Wallis test examining whether respondents' assessments of the university's compliance with CAAP laboratory training standards differed according to academic status. The results revealed no statistically significant difference among the four groups, \(H(3)=3.250\), \(p=0.355\), which is greater than the 0.05 level of significance. Therefore, the null hypothesis is not rejected. This indicates that the respondents' assessments did not significantly vary according to their academic status.

Although the mean ranks differed across groups, with respondents holding a master's degree obtaining the highest mean rank (38.25), followed by those with master's units (29.17), bachelor's degree holders (25.07), and those with doctoral units (8.00), these differences were not statistically significant. Overall, the findings suggest that academic status was not significantly associated with how respondents perceived the university's compliance with CAAP laboratory training standards.

8. Plans and programs to enhance the delivery of laboratory-based training

Table 8

Plans and programs to enhance the delivery of laboratory-based training

Indicators	Mean	Std. Deviation	Interpretation
1. The institution should upgrade laboratory equipment regularly.	3.60	0.53	Strongly Agree
2. The institution should increase the budget for laboratory resources.	3.54	0.68	Strongly Agree
3. The institution should provide regular instructor training on CAAP standards.	3.50	0.65	Strongly Agree
4. The institution should reduce class size during laboratory sessions.	3.34	0.77	Strongly Agree

Indicators	Mean	Std. Deviation	Interpretation
5. The institution should strengthen safety monitoring procedures.	3.54	0.58	Strongly Agree
6. The institution should improve laboratory scheduling.	3.56	0.58	Strongly Agree
7. The institution should establish partnerships with aviation industries.	3.61	0.53	Strongly Agree
8. The institution should conduct regular laboratory audits.	3.56	0.50	Strongly Agree
9. The institution should modernize laboratory manuals and materials.	3.60	0.61	Strongly Agree
10. The institution should implement continuous improvement programs for laboratory training.	3.68	0.47	Strongly Agree
General Weighted Mean	**3.55**	**0.47**	**Strongly Agree**

Table 8 presents the proposed plans and programs to enhance the delivery of laboratory-based training at the University of Perpetual Help System Laguna–Biñan Campus. The results obtained a general weighted mean of 3.55 (SD = 0.47), interpreted as Strongly Agree, indicating that respondents highly supported the implementation of the identified improvement initiatives.

Among the indicators, implementing continuous improvement programs for laboratory training received the highest mean of 3.68 (SD = 0.47), followed by establishing partnerships with aviation industries (M = 3.61, SD = 0.53). Regularly upgrading laboratory equipment and modernizing laboratory manuals and materials also received high ratings, with means of 3.60 each. These findings highlight the importance of continuous evaluation, industry collaboration, and updated instructional resources in strengthening practical training. Meanwhile, reducing class size during laboratory sessions obtained the lowest mean of 3.34 (SD = 0.77), although it was still interpreted as Strongly Agree. Other proposed initiatives, including increasing the laboratory budget, strengthening safety monitoring, improving laboratory scheduling, providing regular instructor training, and conducting laboratory audits, likewise received strong agreement.

Overall, the findings demonstrate respondents' strong support for institutional initiatives that address resource limitations, instructional quality, safety, and industry relevance. These proposed programs may serve as a basis for developing a comprehensive improvement plan to strengthen laboratory facilities, enhance instructor competencies, promote effective hands-on learning, and ensure the continuous improvement of laboratory-based training in accordance with applicable CAAP requirements.

IV. DISCUSSION

1. Respondents' Demographic Profile

The respondents were predominantly young adults aged 20–29 (92%), male (78%), and had one to five years of experience (88%). Most belonged to the bachelor's degree category (88%). This profile

indicates that the findings largely reflect the perspectives of students and individuals with relatively limited professional experience in aviation maintenance training. Since students constituted the largest portion of the respondents, their assessments provide considerable insight into the actual laboratory learning environment, particularly in terms of equipment availability, instructional supervision, and opportunities for hands-on activities.

2. Perceived Compliance with CAAP Laboratory Training Standards

The respondents generally perceived the university as compliant with CAAP laboratory training standards, obtaining favorable ratings across all indicators. Facilities received the highest mean (M = 3.24, SD = 0.59), while laboratory records and documentation received the lowest (M = 2.98, SD = 0.71). Although both results were interpreted as Compliant, the relatively lower rating for documentation suggests the need to strengthen the recording and monitoring of laboratory activities, equipment inspections, safety procedures, and student performance assessments.

The findings highlight the importance of maintaining systematic training records alongside the actual delivery of laboratory instruction. The International Civil Aviation Organization (ICAO, 2021) emphasizes structured competency-based training and assessment for aircraft maintenance personnel. This reinforces the need for educational institutions to ensure that training activities and competency assessments are properly documented and monitored. Nevertheless, the present findings represent respondents' perceptions and do not independently establish regulatory compliance.

3. Limitations of Facilities and Equipment

The findings revealed that facilities and equipment remain important concerns in laboratory-based training, with a general weighted mean of 2.91 (SD = 0.42). Budget limitations obtained the highest mean (M = 3.48, SD = 0.58), followed by equipment shortages (M = 3.40, SD = 0.67) and delays in equipment repair (M = 3.30, SD = 0.65). Respondents also disagreed that sufficient tools were available for all students (M = 2.30, SD = 0.89) and that laboratory space was adequate for safe activities (M = 2.20, SD = 0.95). These findings indicate that although some existing facilities and equipment were considered functional, their availability and capacity may not sufficiently accommodate students' practical training requirements.

Similarly, Dela Peña (2024) emphasized the importance of preventive maintenance in educational aircraft maintenance laboratories to improve equipment utilization, reduce operational interruptions, and support practical learning. The findings suggest that the institution should prioritize adequate budget allocation, regular equipment maintenance, procurement of additional tools, and improvement of laboratory spaces to provide students with sufficient opportunities for hands-on training.

RSIS International

4. Instructor-Related Factors

Instructor-related factors received a general weighted mean of 3.29 (SD = 0.47), interpreted as Strongly Agree. Clearly explaining laboratory objectives obtained the highest mean (M = 3.44, SD = 0.54), followed by regular training related to CAAP standards (M = 3.40, SD = 0.53) and strict enforcement of safety procedures (M = 3.38, SD = 0.57). These findings indicate that instructors are generally perceived as knowledgeable and capable of guiding students during laboratory activities. However, immediate feedback received the lowest mean (M = 3.12, SD = 0.69), suggesting an opportunity to improve the provision of timely guidance and performance evaluation during practical exercises.

In support of this finding, Kes et al. (2025) emphasized the importance of instructor assessment and calibration in evaluating transversal competencies in aircraft maintenance education. Their study

highlighted the value of combining instructor assessments, peer assessments, self-assessments, and clearly defined performance rubrics. This supports the need to strengthen instructors' capacity not only to demonstrate technical procedures but also to provide consistent feedback and evaluate students' practical competencies.
Delft Repository

5. Student-Related Factors

Student-related factors obtained a general weighted mean of 3.17 (SD = 0.44), interpreted as Agree. Motivation received the highest mean (M = 3.48, SD = 0.54), while the perceived effect of large class sizes on student participation followed closely (M = 3.46, SD = 0.71). These findings suggest that student motivation contributes to participation in laboratory activities, while class size may influence the amount of practical experience and supervision available to each learner. Meanwhile, completing laboratory tasks within the allotted time received the lowest mean (M = 2.84, SD = 0.87), indicating a possible concern regarding students' time management and completion of practical requirements.
Ramoso and Ortega-Dela Cruz (2025) examined factors contributing to Aircraft Maintenance Technology students' readiness for the aviation industry. Their study highlights the importance of preparing students for actual industry expectations and developing the competencies needed for employment. In relation to the present findings, students should be provided with sufficient practical opportunities to strengthen their technical preparation, discipline, task management, and ability to perform laboratory activities within prescribed timeframes.
Sage Journals

6. Challenges Affecting Laboratory Training Effectiveness

The respondents strongly agreed that several challenges affect the effectiveness of laboratory-based training, as reflected in the general weighted mean of 3.26 (SD = 0.39). Large student populations affecting instructional supervision obtained the highest mean (M = 3.44, SD = 0.73), followed by limited funding (M = 3.42, SD = 0.61) and outdated equipment (M = 3.40, SD = 0.67). These results indicate that the challenges are not limited to physical resources but also involve the institution's capacity to provide adequate supervision, sufficient training time, updated equipment, and appropriate instructional support.
Chavan et al. (2025) identified limited access to modern equipment, insufficient resources, and outdated training approaches as barriers to modernizing aviation maintenance education. Their findings further emphasized the need to align training with emerging aircraft technologies and actual industry requirements. Consistent with the present study, addressing laboratory training challenges requires institutional investment in equipment, manageable laboratory class sizes, continuous instructor development, and stronger industry collaboration.
Sage Journals

7. Difference in Respondents' Assessments According to Academic Status

The Kruskal–Wallis test revealed no statistically significant difference in respondents' assessments of the university's compliance with CAAP laboratory training standards when grouped according to academic status, \(H(3) = 3.250\), \(p = 0.355\). Since the p-value was greater than the 0.05 level of significance, the null hypothesis was not rejected. Although respondents with a master's degree obtained the highest mean rank (38.25), followed by those with master's units (29.17), bachelor's degree holders (25.07), and respondents with doctoral units (8.00), the differences were not statistically significant.

The result indicates that the available data did not provide sufficient evidence of differences in respondents' assessments according to academic status. However, the findings should be interpreted cautiously because the group sizes were highly unequal, particularly those with master's and doctoral qualifications. The result should therefore not be taken as definitive evidence that academic status has no influence on respondents' perceptions.

8. Proposed Plans and Programs to Enhance Laboratory-Based Training

The proposed plans and programs obtained a general weighted mean of 3.55 (SD = 0.47), interpreted as Strongly Agree. Implementing continuous improvement programs received the highest mean (M = 3.68, SD = 0.47), followed by establishing partnerships with aviation industries (M = 3.61, SD = 0.53). Regular upgrading of laboratory equipment and modernization of laboratory manuals and materials also received high ratings. These findings demonstrate respondents' strong support for institutional initiatives that improve laboratory resources, strengthen instructional delivery, and ensure that practical training remains relevant to industry requirements.

Carpio and Pereyra (2025), in their study on technical education learning spaces in Batangas, identified deficiencies in infrastructure, equipment, industry alignment, and instructional materials. Their findings emphasized the need to modernize learning environments to better respond to technical education requirements. This supports the present study's proposed initiatives, particularly equipment upgrading, improved laboratory resources, and stronger industry partnerships. Overall, the findings provide a basis for developing a continuous improvement program focused on laboratory modernization, instructor development, safety monitoring, industry collaboration, and regular evaluation of training delivery.

V. CONCLUSION

The study concludes that laboratory-based training at the University of Perpetual Help System Laguna–Biñan Campus is generally perceived by respondents as compliant with CAAP laboratory training standards. However, several challenges remain, particularly limited funding, insufficient equipment, inadequate laboratory space, equipment maintenance, and large class sizes. Instructor and student factors also contribute to training effectiveness, highlighting the importance of proper supervision, student motivation, and sufficient opportunities for hands-on learning. No statistically significant difference was found in respondents' assessments when grouped according to academic status.

The findings imply the need for stronger institutional support to improve laboratory training delivery. The university should prioritize equipment upgrading, adequate budget allocation, regular instructor development, improved laboratory scheduling, strengthened safety monitoring, and systematic documentation. Establishing partnerships with aviation industries and implementing continuous improvement programs may further enhance the relevance and quality of practical training while supporting alignment with applicable CAAP requirements.

Future studies may examine laboratory training practices across multiple CAAP-approved training organizations to provide broader comparisons and more comprehensive findings. Researchers may also consider larger and more balanced respondent groups, objective assessments of regulatory compliance, and direct evaluation of students' practical competencies. Further investigation of industry partnerships, equipment utilization, and the effectiveness of proposed improvement programs is likewise recommended to support evidence-based decisions and the continuous enhancement of aviation maintenance education.

REFERENCES

11. Carpio, C. C., & Pereyra, J. G. (2025). Enhancing technical education learning spaces: Development of laboratory model for technical drafting in vocational schools in Batangas. International Journal of Science and Technology Education. https://ijste.psu.edu.ph/index.php/about/article/view/26
12. Chavan, D., Nicklin, Z., Ley, S., Upadhyay, B., Maguire, C., Johnson, K., Short, R., Gramopadhye, A., & Madathil, K. C. (2025). Bridging the gap in aviation maintenance education: Identifying emerging technologies and workforce needs. Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 69(1), 1893–1895. https://doi.org/10.1177/10711813251370725
13. Chavan, D., Nicklin, Z., Ley, S., Upadhyay, B., Maguire, C., Johnson, K., Short, R., Gramopadhye, A., & Madathil, K. C. (2025). Bridging the gap in aviation maintenance education: Identifying emerging technologies and workforce needs. Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 69(1), 1893–1895. https://doi.org/10.1177/10711813251370725
14. Civil Aviation Authority of the Philippines. (2023). Philippine Civil Aviation Regulations (PCAR), Part 3: Approved Training Organizations (July 2023 ed.). https://caap.gov.ph/wp-content/uploads/2023/09/PART-3-Approved-Training-Organizations.pdf
15. Dela Peña, A. (2024). Optimization of preventive maintenance procedures for aircraft systems in an educational laboratory setting. International Journal of Research and Scientific Innovation. https://doi.org/10.51244/IJRSI.2024.1109062
16. Dela Peña, A. (2024). Optimization of preventive maintenance procedures for aircraft systems in an educational laboratory setting. International Journal of Research and Scientific Innovation. https://doi.org/10.51244/IJRSI.2024.1109062
17. Dela Peña, A., Ganal, M. A. M., Tiansay, E. B., & Pasia, J. C. (2025). A multi-framework case study on advancing outcome-based education in Aircraft Maintenance Technology. International Journal of Academe and Industry Research, 6(3). https://doi.org/10.53378/ijair.353253
18. Dela Peña, A., Rutao, M., & Tiglao, H. (2025). Addressing competency gaps in aviation maintenance education: Lessons from the Philippine experience. Journal of Technical Education and Training, 17(2), 165–181. https://doi.org/10.30880/jtet.2025.17.02.012
19. International Air Transport Association. (n.d.). Guidelines for maintenance training. https://www.iata.org/en/publications/manuals/guidelines-for-maintenance-training/
20. International Civil Aviation Organization. (2020). Procedures for air navigation services—Training (Doc 9868) (3rd ed.). ICAO.
21. International Civil Aviation Organization. (2021). Manual on competency-based training and assessment for aircraft maintenance personnel (Doc 10098). ICAO. https://store.icao.int/en/manual-on-competency-based-training-and-assessment-for-aircraft-maintenance-personnel-doc-10098
22. International Civil Aviation Organization. (2021). Manual on competency-based training and assessment for aircraft maintenance personnel (Doc 10098). ICAO.
23. Kes, L., Pietersma, B., Saunders-Smits, G., & Specht, M. M. (2025). Valid assessment of transversal competencies in aircraft maintenance: Insights from focus groups with industry stakeholders. The ATEC Journal, 47(2), 26–45.
24. Kes, L., Pietersma, B., Saunders-Smits, G., & Specht, M. M. (2025). Valid assessment of transversal competencies in aircraft maintenance: Insights from focus groups with industry stakeholders. ATEC Journal, 47(2), 26–45. https://repository.tudelft.nl/record/uuid:d52f2b42-7d80-4961-ab0f-002c3c91c44e

25. Kes, L., Saunders-Smits, G., Specht, M. M., & colleagues. (2026). Towards new educational standards for aircraft maintenance: Analysing transversal competencies on industry safety priorities and assessment challenges. Cogent Education, 13(1), Article 2629672. https://doi.org/10.1080/2331186X.2026.2629672
26. Kes, L., Specht, M. M., Abbink, D. A., & Saunders-Smits, G. (2026). Critical success factors for programmatic assessment of communication and teamwork in aircraft maintenance engineering education. SEFI Journal of Engineering Education Advancement, 3(2), 78–112.
27. Kes, L., van Wesel, F., Saunders, G. N., & Specht, M. (2026). Establishing valid criteria for assessing transversal competencies in aircraft maintenance education: A Delphi study. Cogent Education, 13(1), Article 2726606. https://doi.org/10.1080/2331186X.2026.2726606
28. Ramoso, M. G. D., & Ortega-Dela Cruz, R. A. (2025). Contributing factors to Aircraft Maintenance Technology students' readiness for the aviation industry. Collegiate Aviation Review International, 43(1), 65–81.
29. Ramoso, M. G. D., & Ortega-Dela Cruz, R. A. (2025). Contributing factors to aircraft maintenance technology students' readiness for the aviation industry. Collegiate Aviation Review International, 43(1), 65–81. https://ojs.library.okstate.edu/osu/index.php/CARI/article/view/10115