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Assessment of Laboratory Management Practices and Their Impact on the Academic Self-Efficacy of In-Service Teachers Enrolled in Technical-Vocational Education Programs at NEUST

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Abstract

Effective laboratory management is essential in Technical-Vocational Education (TVE) as it supports experiential learning, skills development, and academic confidence among in-service teachers. This study examined the relationship between laboratory management practices and academic self-efficacy among in-service teachers enrolled in the Master of Arts in Teaching–Technical-Vocational Education (MAT-TVTE) program at Nueva Ecija University of Science and Technology (NEUST) Graduate School. A quantitative descriptive-correlational research design was employed involving 85 in-service teachers selected through simple random sampling. Data were collected using a researcher-developed questionnaire assessing laboratory management practices in terms of planning and scheduling, equipment maintenance, inventory control, supervision and utilization, safety management, and waste management, as well as academic self-efficacy in terms of mastery experiences, vicarious experiences, social persuasion, and physiological/affective states.

Findings revealed that respondents demonstrated very high laboratory management practices, with supervision and utilization obtaining the highest weighted mean (WM = 4.80). Respondents also exhibited a high level of academic self-efficacy, with social persuasion obtaining the highest weighted mean (WM = 4.82). Furthermore, a statistically significant strong positive relationship was found between laboratory management practices and academic self-efficacy ($r = .637$, $p < .001$).

The findings suggest that effective laboratory management practices contribute significantly to enhancing the confidence, motivation, and academic performance of in-service teachers in Technical-Vocational Education programs. The study underscores the importance of strengthening laboratory management systems, professional development programs, and supportive learning environments to further improve academic self-efficacy among graduate school learners.

Keywords: Laboratory Management Practices, Academic Self-Efficacy, Technical-Vocational Education, In-Service Teachers, Graduate School, Laboratory Instruction

Introduction

As technology advances and businesses' needs change, the need for effective teaching in Technical-Vocational Education and Training (TVET) grows. In this situation, learning is more than just memorizing facts and numbers. It also needs places where people can learn by doing and practicing what they already know. This is especially important for teachers who are currently working and taking Technical-Vocational Education classes. They need to put what they learn in class and the lab to use. The lab is a big part of learning by doing because it lets students put what they learn in class into practice. For laboratory-based training to work, the facilities and management techniques must be adequate enough. This encompasses planning and scheduling, maintaining equipment in optimal condition, monitoring supplies, utilizing and supervising equipment, ensuring safety, and disposing of waste. Research indicates that effective planning and scheduling enhance lesson effectiveness and optimize learning time (Darling-Hammond *et al*., 2022) [7]. Taking care of the equipment and keeping track of the supplies, on the other hand, ensures that the lab runs well and that resources are used in the best possible way (OECD, 2021) [19]. People are

also more interested when they are monitored and when they use things properly, as this accountability can lead to increased engagement and a deeper understanding of the material being taught. Safety and waste-management systems make learning environments safer and more sustainable (World Bank, 2022) [29]. Such an environment can help teachers feel more confident in their academic skills by providing them with a better place to teach and more resources. These attributes collectively affect the learning environment and may influence educators' academic self-efficacy, defined as the belief in one's ability to perform academic tasks competently (Bandura, 1997; Schunk & DiBenedetto, 2021) [3, 21]. There is a lack of research examining the impact of laboratory management strategies on the academic self-efficacy of currently employed educators, particularly at institutions such as the Nueva Ecija University of Science and Technology (NEUST).

UNESCO and the International Labour Organization share a mission: they're working together to make Technical and Vocational Education and Training better suited for today's global job market. Their main focus, building labs that actually mimic real-world situations, so people can genuinely build up their skills. Recent studies indicate that when labs are managed well, students dive in with more confidence, pick up skills faster, and feel more sure of themselves—especially in today's Industry 4.0 world. Industry 4.0 is basically all about advanced manufacturing, automation, IoT, and AI. Still, most research looks at lab infrastructure and pre-service teachers—we're not hearing much about the folks who are already teaching. There's also not much solid evidence connecting how labs are managed—like how schedules work, how reliable the equipment is, safety measures, or how resources are used—to psychological impacts, including how confident students feel in their abilities. Social cognitive theory says self-efficacy is shaped by actual accomplishments, observing others, encouragement, and emotional state. Real-life studies back this up. When classrooms are structured and supportive, people gain more mastery experiences and feel less anxious, which helps boost their confidence.

The Technical Education and Skills Development Authority and the Department of Education in the Philippines keep pushing for more hands-on, competency-based training. They've tried to upgrade facilities and manage resources better (TESDA, 2022; Department of Education, 2023) [23, 8], but a number of old problems just won't go away. Equipment's outdated, funding comes up short, maintenance systems don't always work, and safety rules aren't consistent (Asian Development Bank, 2022), which collectively hinder the effectiveness of the training programs and the ability of educators to provide quality instruction. All these factors hinder teachers from fully mastering the material, and at times, they undermine their confidence in their abilities.

The Nueva Ecija University of Science and Technology really helps TVET programs move forward in the area. Still, students have trouble getting enough lab supplies, using what they do have well, and making sure that everyone can easily get to the facilities by coordinating their schedules, which hinders their ability to fully engage in practical learning experiences essential for their technical education. All of these factors makes learning tougher and can take a toll on how students view their own abilities. What makes it harder is the lack of local studies that really dig into how lab management affects academic self-efficacy. Because of these factors, institutions don't have the hard data they need to make smart improvements. That's why this study steps in—to look closely at how laboratory management works at NEUST and see how it shapes the academic self-efficacy of in-service teachers in Technical-Vocational Education programs.

Statement of the Problem

This study aims to know the relationship of Laboratory Management Practices and Academic Self - Efficacy of In-Service Teachers Enrolled in the Master of Arts in Teaching – Technical-Vocational Education Program at NEUST Graduate School. Specifically, this study seeks to answer the following questions:

1. What is the profile of the respondents in terms of:
   1.1 Age;
   1.2 Sex;
   1.3 Years of Teaching Experience
   1.4 Employment Status; and
   1.5 Institution/Agency Affiliation?
2. What are the laboratory management practices of the respondents in terms of:
   2.1 Planning and Scheduling;
   2.2 Equipment Maintenance;
   2.3 Inventory Control;
   2.4 Supervision and Utilization;
   2.5 Safety Management; and
   2.6 Waste Management?
3. What is the level of academic self-efficacy of the respondents in terms of:
   3.1 Mastery Experiences;
   3.2 Vicarious Experiences;
   3.3 Social Persuasion; and
   3.4 Physiological / Affective States?
4. Is there a significant relationship between laboratory management practices and students' academic self-efficacy?
5. What improvements can be proposed to enhance laboratory management practices to improve learning efficiency in the VTE program?

Methodology

Research Design

This study employs descriptive-correlational research design. The descriptive method is used to systematically describe the current status of laboratory management practices and the level of academic self-efficacy of in-service teachers enrolled in the Technical-Vocational Education (TVE) program at NEUST. It focuses on gathering factual information about existing conditions without manipulating any variables.

On the other hand, the correlational method is utilized to determine whether a significant relationship exists between laboratory management practices and academic self-efficacy. This design allows the researcher to examine the degree and direction of association between variables. According to Creswell (2023) [6], descriptive-correlational research is appropriate when the goal is to describe variables and analyze relationships among them without any experimental intervention.

This design is suitable for the present study because it aims to assess the level of laboratory management practices and

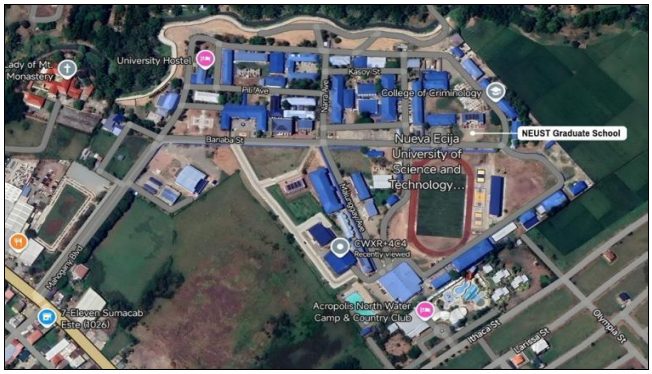
determine how these practices are related to the learning efficiency of in-service teachers.

Research Locale

This study will be conducted at Nueva Ecija University of Science and Technology (NEUST), a public state university located in Cabanatuan City, Philippines. The university offers graduate programs in Technical-Vocational Education, including the Master of Arts in Teaching major in Vocational-Technical Education (MAT-VTE) under its Graduate School. NEUST is equipped with laboratories and classrooms that support both theoretical instruction and hands-on learning, which are utilized by graduate students during their academic training.

The study focuses on in-service teachers enrolled in the Graduate School who engage in laboratory-based learning while enhancing their pedagogical and technical competencies. The university's laboratories provide an environment where respondents apply theoretical knowledge, perform technical tasks, and develop professional skills relevant to their teaching fields.

Moreover, as the respondents are both practicing teachers and graduate students, the NEUST laboratory setting reflects an authentic environment where teaching and learning intersect. This makes it a suitable context for examining how laboratory management practices influence learning efficiency. Furthermore, UNESCO (2023) [25] emphasizes that effective learning environments play a crucial role in skills development and the improvement of instructional quality.



Source: Google Map

Fig 2: Map of Nueva Ecija University of Science and Technology (NEUST), Graduate School

Respondents

The respondents of the study are Master of Arts in Teaching (MAT) students majoring in Technical-Vocational Education (VTE) at Nueva Ecija University of Science and Technology (NEUST) during the second semester. These respondents are currently employed as teachers handling technical-vocational courses while pursuing advanced studies in education.

They were selected as respondents because they perform dual roles as both teachers and students. This unique position provides them with both practical teaching experience and academic exposure to laboratory-based instruction. As both users of laboratory facilities and facilitators of learning in similar environments, they are capable of providing informed and relevant evaluations of laboratory management practices.

Using Slovin's formula, a sample of 86 respondents was determined from a total population of 110 MAT-VTE students consisting of 38 males and 73 females in a period of 2nd semester 2025-2026. These respondents are considered suitable for the study due to their substantial experience in conducting laboratory activities in their teaching practice and their active participation in laboratory-based learning during their graduate studies. Thus, they are able to provide accurate and meaningful insights into laboratory management practices and academic self-efficacy.

Sampling Procedure

The respondents of the study will be selected from a total population of 110 Master of Arts in Teaching (MAT) major in Vocational Technological Education (VTE) students enrolled during the second semester. To determine the appropriate sample size, the researcher will use Slovin's Formula, which is commonly applied when the population size is known and a representative sample is needed. Using a 5% margin of error (0.05), the computed sample size is 86 respondents, rounded down to the nearest whole number for practical purposes. The study will employ simple random sampling in selecting the respondents, ensuring that each member of the population has an equal opportunity to be chosen. This sampling technique helps minimize selection bias and promotes fair representation of the population, thereby increasing the reliability of the study findings (Etikan & Bala, 2017) [9].

Inclusion and Exclusion Criteria

To ensure the validity and reliability of the data gathered, specific inclusion and exclusion criteria were established in selecting the respondents of the study.

Inclusion Criteria

Respondents must meet the following qualifications to be included in the study:

1. They must be currently enrolled as in-service teachers in the Technical-Vocational Education (TVE) program at Nueva Ecija University of Science and Technology (NEUST).
2. They must be actively teaching in either public or private educational institutions during the conduct of the study.
3. They must have prior or current exposure to laboratory or workshop activities, including the use and management of laboratory facilities as part of their coursework or training.
4. They must be willing to participate voluntarily and provide informed consent.
5. They must be available and able to complete the research instrument (Survey Questionnaire) within the designated data collection period.

Exclusion Criteria

Respondents will be excluded from the study if they meet any of the following conditions:

1. They are not enrolled in the Technical-Vocational Education (TVE) program at Nueva Ecija University of Science and Technology (NEUST).
2. They are pre-service teachers or individuals who are not currently engaged in teaching.

3. They have no experience or exposure to laboratory or workshop management practices.
4. They fail to complete the research instrument or provide incomplete responses.
5. They decline participation or withdraw consent at any stage of the study.

Procedure of the Study

The study will follow a systematic procedure to ensure proper data collection and analysis. First, the researchers will prepare the research instrument and submit it for expert validation. After incorporating necessary revisions, a formal letter of request will be prepared and submitted to the appropriate authorities of NEUST to seek permission to conduct the study.

Once permission is granted, the researchers will identify the selected respondents based on the sampling procedure. The purpose of the study will be clearly explained to the respondents, and they will be informed about their voluntary participation. The questionnaires will then be distributed to the respondents and sufficient time will be given for them to answer. After completion, the questionnaires will be collected, checked, and organized.

The gathered data will then be encoded, tabulated, and analyzed using appropriate statistical tools. Finally, the results will be interpreted, and conclusions and recommendations will be formulated based on the findings of the study (Fraenkel *et al*., 2019) [11].

Description of the Questionnaire

The first part of the questionnaire was the demographic profile of the respondents, which composed of age; sex; years of teaching; employment status; and institution/agency affiliation. On the second part was the assessment for laboratory management practices in terms of Planning and scheduling; Equipment maintenance; Inventory control; and Supervision and utilization; Safety Management and Waste Management. the third part was the assessment for learning efficiency in terms of Mastery Experiences; Vicarious Experiences; Social Persuasion; and Physiological / Affective States.

The questionnaire made by the researcher is based on the variables found in the conceptual framework, especially learning efficiency and laboratory management practices. The researchers used the 5 point-scale type of Likert Scale for determining the degree of responses of the respondents. The directions of questions were translated to Filipino to be able for the respondents to understand the questions clearly. Therefore, the respondent can answer the questionnaire properly.

Table 2.5: Point Likert Scale Range, Numerical Values and Verbal Interpretation

Rating Scale	Numerical Values	Descriptive Value
5	4.21 – 5.00	Strongly Agree
4	3.41 – 4.20	Agree
3	2.61 – 3.40	Moderately Agree
2	1.81 – 2.60	Disagree
1	1.00 – 1.80	Strongly Disagree

The 5-point Likert scale is used to measure the level of agreement of respondents on laboratory management practices and learning efficiency. Responses are interpreted based on the given scale, which includes numerical and descriptive values. A mean score of 4.21–5.00 indicates Strongly Agree, 3.41–4.20 indicates Agree, 2.61–3.40 indicates Moderately Agree, 1.81–2.60 indicates Disagree, and 1.00–1.80 indicates Strongly Disagree.

Validity and Reliability of the Instrument

The questionnaire will be submitted to the research adviser and subject matter experts for review, suggestions, and content validation. This process will ensure that the items are clear, relevant, and aligned with the objectives of the study.

After validation, a pilot test will be conducted with a small group of respondents who are not part of the actual sample. This will be done to assess the reliability and clarity of the instrument. Necessary revisions will be made based on the feedback obtained prior to the final administration (Creswell & Creswell, 2023).

Administration and Retrieval of the Questionnaire

The researcher will seek permission from the Dean of the Graduate School and the Chairperson of the Vocational Technological Education program prior to administering the questionnaire. Upon approval, the questionnaire will be distributed to the selected respondents through an online platform using Google Forms.

A link to the questionnaire will be sent to the respondents through appropriate communication channels. The purpose of the study will be clearly stated in the form, along with assurances of confidentiality, and that all responses will be used solely for research purposes.

Respondents will be given sufficient time to accomplish the questionnaire. Responses will be automatically recorded and collected through Google Forms, ensuring efficient data retrieval. The researcher will regularly monitor the response rate and send follow-up reminders, if necessary, to ensure maximum participation. All collected data will be reviewed for completeness before proceeding to data analysis.

Data Analysis

The collected data will be analyzed using appropriate statistical tools to answer the research questions and test the hypothesis. The study focuses on determining the level of relationship and the effect of laboratory management practices on the academic self-efficacy of in-service teachers enrolled in the Vocational Technological Education program.

Frequency and percentage will be used to describe the distribution of respondents and to summarize responses where applicable.

Weighted mean will be used to determine the level of laboratory management practices and the level of learning efficiency. This will help identify whether the variables are high, moderate, or low based on the respondents' perceptions.

Standard deviation will be used to determine the variability or consistency of the responses. A lower standard deviation indicates more consistent responses, while a higher value indicates greater variation.

Formula of Weighted Mean

$$WM = \frac{\text{TWF}}{\text{N}}$$

Where:
TWF = Total Weighted Frequency
N = Number of Respondents
WM = Weighted Mean

Formula of Percentage

$$P = \frac{f}{N} x\ 100$$

Where:
P = Percentage
N = Number of Respondents
f = Frequency

The Pearson Product-Moment Correlation Coefficient (Pearson r) will be used to determine the strength and direction of the relationship between laboratory management practices and academic self-efficacy. This statistical tool is appropriate for analyzing the data, as the study aims to describe the variables and examine their relationship quantitatively. (Creswell & Creswell, 2023).

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]}}$$

Results and Discussion

1. The Demographic Profile of TVET Educators

Table 1: Age of the Respondents

Age	Frequency	Percentage
20-29	41	48.2%
30-39	22	25.8%
40-49	16	18.8%
50 and above	6	7.2%
Total	85	100%

Table 1 presents the age distribution of the respondents. The data reveal that the largest group, consisting of 41 respondents (48.2%), falls within the 20–29 age bracket. This is followed by 22 respondents (25.8%) aged 30–39, and 16 respondents (18.8%) aged 40–49. Only 6 respondents (7.2%) are aged 50 years and above. These findings indicate that the majority of the respondents are relatively young educators, suggesting that a large portion of the participants are in the early stages of their teaching careers. This may imply a workforce that is still developing professional experience and adapting to the demands of technical-vocational education.

Table 2: Sex of the Respondents

Sex	Frequency	Percentage
Male	33	38.8%
Female	52	61.2%
Prefer not to say	0	0%
Total	85	100%

Table 2 shows the distribution of respondents according to sex. The results indicate that 52 respondents (61.2%) are female, while 33 respondents (38.8%) are male. No respondent selected "prefer not to say." This implies that female educators comprise the majority of the respondents in this study. The data reflect a higher representation of women among the participating TVET educators.

Table 3: Years of Teaching Experience of the Respondents

Years of Teaching Experience	Frequency	Percentage
Less than 1 year	17	20.0%
1–5 years	37	43.5%
6–10 years	20	23.5%
11 years and above	11	13.0%
Total	85	100%

Table 3 presents the respondents' years of teaching experience. The data show that the largest group, 37 respondents (43.5%), has 1–5 years of teaching experience. This is followed by 20 respondents (23.5%) with 6–10 years of experience, and 17 respondents (20.0%) with less than one year of teaching. Meanwhile, 11 respondents (13.0%) have been teaching for 11 years and above. These results suggest that most of the respondents are relatively early in their teaching careers, with a substantial number having less than five years of experience. This indicates a developing level of professional practice and growing exposure to teaching responsibilities.

Table 4: Employment Status of the Respondents

Employment Status	Frequency	Percentage
Permanent	49	57.7%
Contractual	12	14.1%
Part-time	24	28.2%
Total	85	100%

Table 4 presents the employment status of the respondents. The data show that 49 respondents (57.7%) hold permanent positions, while 24 respondents (28.2%) are employed on a part-time basis, and 12 respondents (14.1%) are contractual. This indicates that more than half of the respondents have stable employment, which may contribute to continuity in teaching and professional development. However, a notable proportion of respondents are in non-permanent roles, suggesting variability in employment conditions within the group.

Table 5: Institution/Agency Affiliation of the Respondents

Institution/Agency Affiliation	Frequency	Percentage
Junior/Senior High School (TLE/TVL)	55	64.7%
College/University	27	31.8%
TESDA/TVET Training Center	3	3.5%
Total	85	100%

Table 5 presents the institutional or agency affiliation of the respondents. The data reveal that the majority, 55 respondents (64.7%), are affiliated with junior or senior high schools offering TLE/TVL programs. This is followed by 27 respondents (31.8%) from colleges or universities, while only 3 respondents (3.5%) are connected with TESDA or TVET training centers.

These findings indicate that most respondents are engaged in secondary-level technical-vocational education, highlighting a strong representation of educators involved in skills-based instruction at the basic education level. However, this distribution reflects only the composition of the selected respondents and should not be generalized beyond the study sample.

2. Laboratory Management Practices of the Respondents

2.1 Planning and Scheduling

Table 6: Planning and Scheduling

S. No	Planning and Scheduling	Total Weighted Frequency	Weighted Mean	Standard Deviation	Verbal Interpretation
1	Laboratory activities are planned in alignment with required competencies.	410	4.82	0.441	Strongly Agree
2	A structured schedule is followed during laboratory sessions.	405	4.76	0.479	Strongly Agree
3	Time is effectively allocated for each laboratory task.	405	4.76	0.503	Strongly Agree
4	Laboratory lessons are organized prior to implementation.	404	4.75	0.510	Strongly Agree
5	Instructional objectives are clearly defined before laboratory activities begin.	410	4.82	0.467	Strongly Agree
6	Laboratory activities are sequenced logically to support skill development.	409	4.81	0.450	Strongly Agree
7	Available time is maximized during laboratory instruction.	402	4.73	0.497	Strongly Agree
8	Planning of laboratory sessions considers the needs and abilities of students.	409	4.81	0.450	Strongly Agree
	Total	**38.28**	4.79		Strongly Agree

The respondents demonstrated a very high level of planning and scheduling practices, with an overall weighted mean (WM) of 4.78 with a descriptive value of Strongly Agree, and item means ranging from 4.73 to 4.82. The standard deviation values (0.441–0.510) indicate consistent responses among the respondents. The highest-rated indicators were *"Laboratory activities are planned in alignment with required competencies"* and *"Instructional objectives are clearly defined"* (M = 4.82), while *"Available time is maximized during laboratory instruction"* obtained the lowest mean (M = 4.73), although it still falls within the very high category. These findings suggest that the respondents consistently apply systematic planning practices that support effective laboratory instruction. Clear instructional objectives, competency alignment, and organized laboratory activities contribute to improved teaching efficiency and student learning outcomes. However, the relatively lower rating for time maximization indicates a need to further enhance time management during laboratory instruction.

These findings are consistent with Shasha Lin (2024) [17], who emphasized that effective laboratory scheduling and proper resource allocation improve teaching quality and laboratory efficiency by reducing instructional inefficiencies and facilitating better laboratory management.

2.2 Equipment maintenance

Table 7: Equipment maintenance

S. No	Equipment maintenance	Total Weighted Frequency	Weighted Mean	Standard Deviation	Verbal Interpretation
1	Laboratory equipment is inspected regularly before use.	393	**4.62**	**0.707**	**Strongly Agree**
2	Tools and equipment are maintained in good working condition.	390	**4.59**	**0.695**	**Strongly Agree**
3	Preventive maintenance procedures are consistently implemented.	394	**4.64**	**0.652**	**Strongly Agree**
4	Defective equipment is addressed promptly.	381	**4.48**	**0.781**	**Strongly Agree**
5	Equipment is cleaned and stored properly after use.	398	**4.68**	**0.621**	**Strongly Agree**
6	Maintenance procedures are followed according to standard guidelines.	389	**4.58**	**0.730**	**Strongly Agree**
7	Functional equipment is ensured prior to laboratory activities.	393	**4.62**	**0.672**	**Strongly Agree**
8	Records of equipment maintenance are properly kept.	394	**4.64**	**0.633**	**Strongly Agree**
	Total	**36.85**	**4.61**		**Strongly Agree**

The respondents demonstrated a very high level of equipment maintenance practices, with an overall weighted mean (WM) of 4.61 with a descriptive value of Strongly Agree, and item means ranging from 4.48 to 4.68. The standard deviation values (0.621–0.781) indicate moderate consistency in the responses. The highest-rated indicator was *"Equipment is cleaned and stored properly after use"* (M = 4.68), while *"Defective equipment is addressed promptly"* obtained the lowest mean (M = 4.48), although it remained within the very high category. These findings indicate that the respondents consistently observe proper equipment maintenance practices that promote laboratory safety, functionality, and operational efficiency. However, the relatively lower rating for promptly addressing defective

equipment suggests minor delays or limitations in responding to equipment-related concerns, indicating an area that may still require improvement.

Similar findings were reported by King *et al*. (2025) [15], who emphasized that regular maintenance, monitoring, and prompt repair of laboratory equipment improve laboratory effectiveness, ensure safety, and support better learning experiences during practical activities.

2.3 Inventory control

Table 8: Inventory control

S. No	Inventory control	Total Weighted Frequency	Weighted Mean	Standard Deviation	Verbal Interpretation
1	An updated inventory of laboratory tools and materials is maintained.	387	**4.55**	**0.699**	**Strongly Agree**
2	Laboratory supplies are monitored before and after use.	390	**4.59**	**0.695**	**Strongly Agree**
3	Inventory records are updated regularly.	387	**4.55**	**0.716**	**Strongly Agree**
4	Materials needed for laboratory activities are readily available.	386	**4.54**	**0.765**	**Strongly Agree**
5	Issuance and return of tools are properly recorded.	383	**4.51**	**0.718**	**Strongly Agree**
6	Loss or damage of equipment is properly documented.	387	**4.55**	**0.699**	**Strongly Agree**
7	Inventory procedures are followed consistently.	389	**4.58**	**0.697**	**Strongly Agree**
8	Laboratory resources are accounted for after each activity.	392	**4.61**	**0.619**	**Strongly Agree**
	Total	**36.48**	**4.56**		**Strongly Agree**

The respondents demonstrated a very high level of inventory control practices, with an overall weighted mean (WM) of 4.56 with a descriptive value of Strongly Agree, and item means ranging from 4.51 to 4.61. The standard deviation values (0.619–0.765) indicate moderate consistency among the responses. The highest-rated indicator was *"Laboratory resources are accounted for after each activity"* (M = 4.61), while *"Issuance and return of tools are properly recorded"* obtained the lowest mean (M = 4.51), although it still falls within the very high category. These findings suggest that the respondents effectively manage and monitor laboratory inventory, ensuring that materials and resources are properly tracked and available when needed. The consistent implementation of inventory practices contributes to improved organization and operational efficiency in laboratory management. However, the relatively lower rating for recording the issuance and return of tools may indicate minor lapses in documentation procedures that may still be improved.

These findings align with the discussion of Bradley (2025) [4], who emphasized that effective laboratory inventory management improves operational efficiency, maintains organization, reduces waste, and ensures the availability of laboratory materials and equipment when needed.

2.4 Supervision and Utilization

Table 9: Supervision and Utilization

S. No	Supervision and Utilization	Total Weighted Frequency	Weighted Mean	Standard Deviation	Verbal Interpretation
1	Students are closely supervised during laboratory activities.	412	**4.85**	**0.394**	**Strongly Agree**
2	Proper use of tools and equipment is ensured at all times.	409	**4.81**	**0.450**	**Strongly Agree**
3	Laboratory resources are utilized effectively during instruction.	404	**4.75**	**0.486**	**Strongly Agree**
4	Guidance is provided to students while performing laboratory tasks.	411	**4.84**	**0.432**	**Strongly Agree**
5	Student engagement is encouraged during laboratory activities.	409	**4.81**	**0.450**	**Strongly Agree**
6	Misuse of tools and equipment is immediately addressed.	406	**4.78**	**0.472**	**Strongly Agree**
7	Laboratory activities are monitored to ensure proper task execution.	404	**4.75**	**0.486**	**Strongly Agree**
8	Available resources are maximized to support learning outcomes.	409	**4.81**	**0.422**	**Strongly Agree**
	Total	**38.40**	**4.80**		**Strongly Agree**

The respondents demonstrated a very high level of supervision and utilization practices, with an overall weighted mean (WM) of 4.80 with a descriptive value of Strongly Agree, and item means ranging from 4.75 to 4.85. The standard deviation values (0.394–0.486) indicate highly consistent responses among the respondents. The highest-rated indicator was *"Students are closely supervised during laboratory activities"* (M = 4.85), while *"Laboratory resources are utilized effectively"* and *"Laboratory activities are monitored"* obtained the lowest means (M = 4.75), although they still fall within the very high category. These findings suggest that the respondents consistently demonstrate strong supervision practices that promote proper guidance, student engagement, and the appropriate use of laboratory tools and equipment. Effective supervision contributes to a safe and productive laboratory learning environment. However, the relatively lower ratings for resource utilization and activity monitoring indicate that there is still room to further enhance monitoring efficiency and optimize the use of laboratory resources.

These findings are consistent with Wahira *et al*. (2023) [28], who emphasized that effective laboratory supervision improves safety, equipment utilization, and students' learning experiences through consistent monitoring and guidance during practical activities.

2.5 Safety management

Table 10: Safety management

S. No	Safety management	Total Weighted Frequency	Weighted Mean	Standard Deviation	Verbal Interpretation
1	Safety procedures are clearly communicated before laboratory activities.	394	**4.64**	**0.800**	**Strongly Agree**
2	Safety rules are consistently implemented in the laboratory.	402	**4.73**	**0.714**	**Strongly Agree**
3	Personal protective equipment (PPE) is used during laboratory work.	397	**4.67**	**0.746**	**Strongly Agree**
4	Potential hazards are identified prior to laboratory activities.	397	**4.67**	**0.793**	**Strongly Agree**
5	Safety guidelines are followed during the use of tools and equipment.	395	**4.65**	**0.812**	**Strongly Agree**
6	Emergency procedures are known and understood.	394	**4.64**	**0.800**	**Strongly Agree**
7	Unsafe practices are corrected immediately.	396	**4.66**	**0.839**	**Strongly Agree**
8	The laboratory environment is maintained to ensure safety at all times.	393	**4.62**	**0.831**	**Strongly Agree**
	Total	**37.27**	**4.66**		**Strongly Agree**

The respondents demonstrated a very high level of supervision and utilization practices, with an overall weighted mean (WM) of 4.80 with a descriptive value of Strongly Agree, and item means ranging from 4.75 to 4.85. The standard deviation values (0.394–0.486) indicate highly consistent responses among the respondents. The highest-rated indicator was *"Students are closely supervised during laboratory activities"* (M = 4.85), while *"Laboratory resources are utilized effectively"* and *"Laboratory activities are monitored"* obtained the lowest means (M = 4.75), although they still fall within the very high category. These findings suggest that the respondents consistently demonstrate strong supervision practices that promote proper guidance, student engagement, and the appropriate use of laboratory tools and equipment. Effective supervision contributes to a safe and productive laboratory learning environment. However, the relatively lower ratings for resource utilization and activity monitoring indicate that there is still room to further enhance monitoring efficiency and optimize the use of laboratory resources.

These findings are consistent with Wahira *et al*. (2023) [28], who emphasized that effective laboratory supervision improves safety, equipment utilization, and students' learning experiences through consistent monitoring and guidance during practical activities.

2.5 Waste Management

Table 11: Waste Management

S. No	Waste Management	Total Weighted Frequency	Weighted Mean	Standard Deviation	Verbal Interpretation
1	Laboratory waste is properly segregated according to its type.	397	**4.67**	**0.585**	**Strongly Agree**
2	Waste containers in the laboratory are clearly labeled according to the type of waste.	394	**4.64**	**0.721**	**Strongly Agree**
3	Hazardous waste materials are separated from non-hazardous waste before disposal.	391	**4.60**	**0.727**	**Strongly Agree**
4	Laboratory waste is disposed of according to established waste disposal procedures.	398	**4.68**	**0.621**	**Strongly Agree**
5	A designated area is available for the temporary storage of laboratory waste prior to disposal.	393	**4.62**	**0.707**	**Strongly Agree**

6	Laboratory waste is promptly collected and removed after each laboratory activity.	397	**4.67**	**0.625**	**Strongly Agree**
7	Procedures are followed to prevent the mixing or contamination of different types of laboratory waste.	397	**4.67**	**0.605**	**Strongly Agree**
8	The laboratory implements practices that reduce the amount of waste generated.	396	**4.66**	**0.628**	**Strongly Agree**
	Total	**37.21**	**4.65**		**Strongly Agree**

The respondents demonstrated a very high level of waste management practices, with an overall weighted mean (WM) of 4.65 with a descriptive value of Strongly Agree, and item means ranging from 4.60 to 4.68. The standard deviation values (0.585–0.727) indicate moderate consistency among the responses. The highest-rated indicator *was "Laboratory waste is disposed of according to established procedures"* (M = 4.68), while *"Hazardous waste materials are separated from non-hazardous waste before disposal"* obtained the lowest mean (M = 4.60), although it still falls within the very high category. These findings suggest that the respondents consistently observe proper waste management practices through appropriate segregation, disposal, and adherence to established laboratory procedures. Effective waste management contributes to laboratory cleanliness, safety, and environmental responsibility. However, the relatively lower rating for hazardous waste segregation indicates that minor lapses in properly distinguishing waste types may still occur. These findings are supported by Nwobi *et al*. (2025) [18], who emphasized that proper waste segregation and safe disposal procedures are essential in minimizing occupational and environmental hazards and promoting sustainable laboratory practices.

3. Laboratory Management Practices of the Respondents

3.1 Mastery Experiences

Table 12: Mastery Experiences

S. No	Mastery Experiences	Total Weighted Frequency	Weighted Mean	Standard Deviation	Verbal Interpretation
1	I am confident in handling academic tasks because of my previous successes.	405	**4.76**	**0.503**	**Strongly Agree**
2	My past success in completing academic requirements helps me perform new tasks effectively.	402	**4.73**	**0.521**	**Strongly Agree**
3	I can accomplish difficult academic activities based on my prior experiences.	398	**4.68**	**0.539**	**Strongly Agree**
4	My previous performance in school-related tasks strengthens my confidence in new challenges.	406	**4.78**	**0.447**	**Strongly Agree**
5	I feel capable of completing laboratory or academic tasks similar to those I have previously performed.	402	**4.73**	**0.521**	**Strongly Agree**
	Total	**23.68**	**4.74**		**Strongly Agree**

The respondents demonstrated a very high level of mastery experiences, with an overall weighted mean (WM) of 4.74 with a descriptive value of Strongly Agree, and item means ranging from 4.68 to 4.78. The standard deviation values (0.447–0.539) indicate consistent responses among the respondents. The highest-rated indicator was *"My previous performance in school-related tasks strengthens my confidence in new challenges"* (M = 4.78), while *"I can accomplish difficult academic activities based on my prior experiences"* obtained the lowest mean (M = 4.68), although it still falls within the very high category. These findings suggest that the respondents strongly rely on previous successful experiences to build confidence and effectively perform academic tasks. Mastery experiences serve as a significant source of academic self-efficacy by strengthening learners' confidence in handling new and challenging activities. However, the relatively lower rating for accomplishing difficult academic tasks suggests that some respondents may still experience minor uncertainty when tasks become more complex.

These findings support the Albert Bandura theory of self-efficacy, which identifies mastery experiences as the strongest source of self-efficacy. Similarly, Law *et al*. (2025) [16] emphasized that successful hands-on learning experiences enhance learners' confidence, competence, and academic preparedness.

3.2 Vicarious Experiences

Table 13: Vicarious Experiences

S. No	Vicarious Experiences	Total Weighted Frequency	Weighted Mean	Standard Deviation	Verbal Interpretation
1	I gain confidence when I observe my classmates successfully completing academic tasks.	403	**4.74**	**0.515**	**Strongly Agree**
2	Watching instructors demonstrate academic or laboratory procedures helps me perform tasks correctly.	404	**4.75**	**0.460**	**Strongly Agree**
3	I believe I can succeed when I see others with similar abilities perform well.	402	**4.73**	**0.521**	**Strongly Agree**
4	Observing effective performance from others motivates me to improve my academic work.	408	**4.80**	**0.431**	**Strongly Agree**
5	I learn effective ways of completing academic tasks by observing others.	403	**4.74**	**0.492**	**Strongly Agree**
	Total	**23.76**	**4.75**		**Strongly Agree**

The respondents demonstrated a very high level of vicarious experiences, with an overall weighted mean (WM) of 4.75 with a descriptive value of Strongly Agree, and item means ranging from 4.73 to 4.80. The standard deviation values (0.431–0.521) indicate consistent responses among the respondents. The highest-rated indicator was *"Observing effective performance from others motivates me to improve my academic work"* (M = 4.80), *while "I believe I can succeed when I see others with similar abilities perform well"* obtained the lowest mean (M = 4.73), although it still falls within the very high category. These findings suggest that the respondents gain confidence and motivation through observing the successful performance of peers, instructors, and other individuals. Vicarious experiences contribute to the development of self-efficacy by helping students learn strategies, strengthen positive academic behaviors, and improve confidence in performing academic tasks. Overall, the findings highlight the important role of observation and modeling in enhancing students' academic confidence and performance.

These findings are consistent with Forbes (2022) [10], who emphasized that vicarious experiences strengthen learners' self-efficacy through observation, reflection, and modeling of others' behaviors and performance.

3.3 Social Persuasion

Table 14: Vicarious Experiences

S. No	Social Persuasion	Total Weighted Frequency	Weighted Mean	Standard Deviation	Verbal Interpretation
1	Encouragement from instructors increases my confidence in completing academic tasks.	410	**4.82**	**0.383**	**Strongly Agree**
2	Positive feedback from peers or instructors strengthens my belief in my academic abilities.	406	**4.78**	**0.472**	**Strongly Agree**
3	I am more motivated to perform well when others express confidence in my abilities.	412	**4.85**	**0.394**	**Strongly Agree**
4	Constructive feedback helps improve my performance in academic activities.	408	**4.80**	**0.431**	**Strongly Agree**
5	Support from colleagues or instructors encourages me to complete challenging tasks.	411	**4.84**	**0.373**	**Strongly Agree**
	Total	**24.08**	**4.82**		**Strongly Agree**

The respondents demonstrated a very high level of social persuasion, with an overall weighted mean (WM) of 4.82 with a descriptive value of Strongly Agree, and item means ranging from 4.78 to 4.85. The standard deviation values (0.373–0.472) indicate highly consistent responses among the respondents. The highest-rated indicator was *"I am more motivated to perform well when others express confidence in my abilities"* (M = 4.85), while *"Positive feedback from peers or instructors strengthens my belief in my academic abilities"* obtained the lowest mean (M = 4.78), although it still falls within the very high category. These findings suggest that encouragement, feedback, and support from others significantly enhance the respondents' motivation and confidence in performing academic tasks. The very high weighted mean further indicates that social persuasion is among the strongest sources of self-efficacy among the respondents. The consistency of responses also reflects shared positive experiences regarding encouragement and interpersonal support.

These findings align with Attiq *et al*. (2017) [2], who emphasized that supportive environments, encouragement, and positive interpersonal interactions contribute significantly to the development of self-efficacy, motivation, and learning confidence.

3.4 Physiological / Affective States

Table 15: Physiological / Affective States

S. No	Physiological / Affective States	Total Weighted Frequency	Weighted Mean	Standard Deviation	Verbal Interpretation
1	I feel calm when performing academic or laboratory tasks.	399	**4.69**	**0.557**	**Strongly Agree**
2	I can manage stress effectively when dealing with difficult academic requirements.	396	**4.66**	**0.524**	**Strongly Agree**
3	I remain confident even when academic tasks are challenging.	397	**4.67**	**0.497**	**Strongly Agree**
4	I can control feelings of anxiety during academic or laboratory activities.	392	**4.61**	**0.537**	**Strongly Agree**
5	I feel emotionally stable when working on complex academic tasks.	398	**4.68**	**0.493**	**Strongly Agree**
	Total	**23.32**	**4.66**		**Strongly Agree**

The respondents demonstrated a very high level of physiological/affective states, with an overall weighted mean (WM) of 4.66 with a descriptive value of Strongly Agree, and item means ranging from 4.61 to 4.69. The standard deviation values (0.493–0.557) indicate moderate consistency in the responses. The highest-rated indicator *was "I feel calm when performing academic or laboratory tasks"* (M = 4.69), while *"I can control feelings of anxiety during academic or laboratory activities"* obtained the lowest mean (M = 4.61), although it still falls within the very high category. These findings suggest that the respondents are generally emotionally stable and capable of managing stress while performing academic and laboratory tasks. Positive emotional states and effective stress management contribute to improved confidence and academic performance. However, the relatively lower rating for controlling anxiety indicates that some respondents may still experience minor emotional challenges during demanding tasks.

These findings are consistent with Jõgi *et al*. (2023) [14], who emphasized that positive emotional well-being and lower stress levels are associated with stronger self-efficacy, improved confidence, and better overall performance.

4. Significant relationship between laboratory management practices and academic self-efficacy.

Table 16: Relationship between laboratory management practices and academic self-efficacy

		Laboratory Management Practices	Student Academic Self-Efficacy
Laboratory Management Practices	Pearson Correlation	1	.637**
	Sig. (2-tailed)		.000
	N	85	85
Student Academic Self-Efficacy	Pearson Correlation	.637**	1
	Sig. (2-tailed)	.000	
	N	85	85

**. Correlation is significant at the 0.01 level (2-tailed)

The Pearson Product-Moment Correlation Coefficient was used to look at the link between laboratory management and student performance. The results showed a correlation coefficient of r = 0.6371, which means that there is a strong positive relationship between the two variables. This means that when laboratory management gets better, students tend to do better as well. Also, the computed p-value is less than 0.001 ($p < .001$), which means that the relationship is statistically significant. Thus, the null hypothesis is rejected.

These findings can be explained by the Social Cognitive Theory by Albert Bandura (1986) which states that an individual's self-efficacy is influenced by environmental factors, social interactions and learning experiences. In the context of this study, effective laboratory management provides a structured and supportive learning environment that allows students to actively participate in tasks, gain hands-on experience and develop confidence in their abilities. Therefore, students feel more effective as they can finish tasks and enjoy guided learning experiences.

In addition, the results support the idea that well-organized laboratory activities, including explicit instructions, appropriate scheduling, and availability of materials, create opportunities for mastery experiences. Mastery experiences are deemed as the most significant source of self-efficacy, as proposed by Bandura (1986). A well-organized environment for laboratory tasks makes students feel more capable of completing laboratory tasks.

Overall, the findings suggest that laboratory management plays a crucial role in shaping student efficacy. Therefore, improving laboratory management practices can significantly enhance students' confidence, motivation, and academic performance.

5. What improvements can be proposed to enhance laboratory management practices to improve Academic Self-Efficacy of In-Service Teachers Vocational Technological Education Graduate School Students.

Proposed Action Plan

Laboratory Management Practices and Academic Self-Efficacy of In-Service Teachers

Laboratory Management Component	Identified Gap	Objective	Proposed Strategy / Intervention	Key Activities	Persons Involved	Timeline	Resources Needed	Success Indicator / Evaluation Measure
Planning and Scheduling	Time utilization is not fully maximized during laboratory instruction (WM = 4.73)	To enhance efficient use of instructional time in laboratory activities	Structured Laboratory Time Management System	▪ Develop standardized time allocation guide per laboratory activity ▪ Implement time monitoring per session ▪ Conduct post-activity reflection on time utilization	▪ Teachers ▪ Program Head	Monthly	▪ Lesson plans ▪ Timer tools ▪ Monitoring checklist	≥95% of laboratory tasks completed within allotted time; improved consistency in session flow
Equipment Maintenance	Delayed response to defective equipment (WM = 4.48)	To ensure prompt identification and repair of defective laboratory equipment	Laboratory Equipment Maintenance Response System	▪ Establish defect reporting logbook ▪ Assign maintenance focal person ▪ Conduct weekly equipment inspection	▪ Lab Custodian ▪ Teachers	Weekly	▪ Maintenance logbook ▪ Repair tools ▪ Inspection checklist	100% of reported defects addressed within 24–48 hours; reduced equipment downtime
Inventory Control	Inconsistent recording of issuance and return of tools (WM = 4.51)	To ensure accurate and systematic tracking of laboratory tools and materials	Standardized Inventory Monitoring System	▪ Implement unified logbook or digital inventory system ▪ Conduct	▪ Lab Custodian ▪ Teachers	Weekly to Monthly	▪ Inventory forms ▪ Logbook ▪ ICT tools	100% tool issuance and return properly recorded; zero inventory discrepancies

				monthly inventory audit ▪ Assign inventory custodian				
Supervision and Utilization	Slight inefficiency in monitoring and resource utilization (WM = 4.75)	To strengthen supervision and maximize utilization of laboratory resources	Enhanced Laboratory Supervision Framework	▪ Develop supervision checklist ▪ Conduct structured observation per session ▪ Optimize student grouping for resource efficiency	▪ Teachers	Every laboratory session	▪ Supervision checklist Monitoring sheet	≥95% student task completion rate; zero misuse of laboratory tools
Safety Management	Inconsistency in maintaining safe laboratory environment (WM = 4.62)	To ensure consistent implementation of laboratory safety standards	Laboratory Safety Compliance Enhancement Program	▪ Conduct weekly safety inspections ▪ Implement safety drills ▪ Reinforce PPE compliance ▪ Conduct hazard identification training	▪ Safety Officer ▪ Teachers ▪ Students	Weekly	▪ PPE ▪ Safety checklist ▪ Hazard signage	Zero recorded laboratory accidents; ≥95% safety compliance rate
Waste Management	Incomplete segregation of hazardous and non-hazardous waste (WM = 4.60)	To improve accuracy in waste segregation and disposal practices	Integrated Laboratory Waste Management Program	▪ Conduct training on waste classification ▪ Install labeled waste bins ▪ Implement waste monitoring checklist	▪ Teachers ▪ Students	Monthly	▪ Waste bins ▪ Labels ▪ IEC materials	100% proper waste segregation; zero mixed waste incidents

Conclusions

The study revealed that the respondents, who were in-service vocational technological education graduate school students, were predominantly young educators, mostly female, with relatively few years of teaching experience. They were primarily affiliated with junior and senior high schools offering TLE/TVL programs. More than half of the respondents held permanent teaching positions, indicating that the workforce is largely composed of developing professionals with stable employment conditions in technical-vocational education.

The findings further showed that the respondents demonstrated a very high level of laboratory management practices across all dimensions, including planning and scheduling, equipment maintenance, inventory control, supervision and utilization, safety management, and waste management. Among these dimensions, supervision and utilization obtained the highest overall mean, indicating that respondents strongly emphasize proper guidance, monitoring, and effective use of laboratory resources during instruction. Although all indicators were rated very highly, minor areas for improvement were observed in addressing time allocation inefficiencies, promptly addressing defective equipment, strengthening monitoring and documentation procedures, improving resource utilization efficiency, ensuring consistent environmental safety conditions, and enhancing hazardous waste segregation practices. Overall, the results suggest that the respondents consistently implement organized, systematic, and safety-oriented laboratory management practices that contribute to effective laboratory instruction and productive learning environments.

The study also revealed that the respondents demonstrated a very high level of academic self-efficacy in terms of mastery experiences, vicarious experiences, social persuasion, and physiological/affective states. Among these dimensions, social persuasion obtained the highest mean, indicating that encouragement, feedback, and support from instructors and peers strongly influence the respondents' confidence and motivation in performing academic and laboratory tasks. The findings further imply that successful experiences, observation of others, and positive emotional regulation significantly contribute to strengthening the respondents' confidence in accomplishing academic responsibilities.

Most importantly, the study established a statistically significant strong positive relationship between laboratory management practices and academic self-efficacy ($r = .637$, $p < .001$). This indicates that improved laboratory management practices are associated with higher levels of academic self-efficacy among in-service teachers in Vocational Technological Education graduate school programs. The findings support the Social Cognitive Theory of Albert Bandura, which emphasizes that supportive learning environments, mastery experiences, and social interactions significantly contribute to the development of

self-efficacy. Effective laboratory management provides learners with structured, organized, and supportive experiences that enhance their confidence, motivation, and perceived capability to accomplish academic and laboratory tasks successfully.

Overall, the study concludes that effective laboratory management practices play a crucial role in strengthening the academic self-efficacy of in-service teachers in Vocational Technological Education graduate school programs. Furthermore, the findings suggest that the continuous enhancement of planning and scheduling, equipment maintenance, inventory control, supervision and utilization, safety management, and waste management practices may further improve learners' confidence, motivation, and academic performance.

Recommendations

Based on the findings and conclusions of the study, it is recommended that educational institutions and administrators in Technical-Vocational Education programs continuously strengthen laboratory management practices to further enhance the academic self-efficacy of in-service teachers. Greater emphasis may be placed on improving planning and scheduling, equipment maintenance, inventory control, supervision and utilization, safety management, and waste management to ensure more organized, efficient, and supportive laboratory learning environments. Although the respondents demonstrated very high levels in all dimensions, specific attention should be given to addressing time allocation inefficiencies, promptly responding to defective equipment, strengthening monitoring and documentation procedures, improving resource utilization efficiency, ensuring consistent environmental safety conditions, and enhancing hazardous waste segregation practices.

It is also recommended that institutions provide regular professional development activities, seminars, and training programs related to laboratory management, instructional supervision, safety protocols, and resource management to help educators continuously improve their competencies in laboratory instruction. Strengthening support systems, constructive feedback mechanisms, and collaborative learning opportunities may further enhance the respondents' confidence, motivation, and academic performance, particularly in terms of mastery experiences, vicarious experiences, social persuasion, and physiological or affective states.

Furthermore, educational administrators may consider establishing standardized laboratory management policies and monitoring systems to ensure the consistent implementation of effective laboratory practices across Technical-Vocational Education programs. Providing adequate laboratory resources, functional equipment, and safe learning environments may also contribute significantly to improving the academic self-efficacy of learners and educators.

Finally, future researchers may conduct similar studies using larger populations, different educational settings, or additional variables related to laboratory instruction and student development. Further investigations may also explore other factors influencing academic self-efficacy and laboratory performance to broaden the understanding of effective laboratory management practices in technical-vocational education.

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