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## Bridging the Laboratory Gap in Filipino Science Teacher Education: Policy-Oriented Reforms

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**Source:** GROK 3 AI's (Twitter/X) image creation function was used to generate the pictorial concept, prompted by: *'Imagine a Filipino pre-service teacher mastering the art and science of laboratory teaching prior to the baccalaureate graduation.'*

**The Problem Rationale:** Pre-service science teacher education in the Philippines faces a significant challenge: insufficient laboratory-based training. The current policy environment prioritizes content knowledge mastery over the practical appreciation of science courses, exacerbating pedagogical, legal, and operational-related gaps in experiential learning, ultimately leaving future science educators underprepared for dynamic laboratory instruction. **Policy Recommendations:** Pedagogical reforms include curriculum reviews, competency mapping, and mandatory laboratory-based instructional training. Legal reforms propose amendments on existing regulatory frameworks to mandate dedicated science laboratories and hands-on instructional requirements. Operational reforms ensure accreditation and rigorous audit of laboratory facilities, faculty development, and financial support for teacher education institutions and internship host schools. **Feasibility Analysis:** The successful implementation of the proposed policy reforms requires a thorough feasibility assessment, examining financial constraints, institutional readiness, and regulatory challenges to ensure their practicality and sustainability in strengthening the laboratory-based avenue in science teacher education in the Philippines. **Conclusion:** Through policy-driven reforms, experiential laboratory training can cultivate a more practice-oriented teaching workforce, ensuring that future Filipino science educators are equipped with the necessary competencies for a holistic science education.

**Keywords:** Science Teacher Education, Laboratory Training, Experiential Learning, Policy-oriented Reforms

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## INTRODUCTION

Teachers are pivotal to the success of any educational system, serving as the primary facilitators of holistic student learning. Science educators, in particular, play a strategic role in fostering scientific literacy, critical thinking, and innovative dispositions, which are essential for national development (Second Congressional Commission on Education [EDCOM] II, 2024; 2025). The United Nations' (UN) Sustainable Development Goal (SDG) no. 4 emphasizes the critical need for *Quality Education*, highlighting the direct link between teacher competence and student achievement (Tatto, 2021). In the Philippines, strengthening science teacher preparation is imperative, as it directly impacts the country's global competitiveness in science and technology (Lansangan & Orleans, 2024).

Despite curricular and instructional mandates promoting inquiry-based learning and technological integration (Camara & Adom, 2024), concerns persist over whether the current pre-service science teacher education system adequately prepares future science educators. A significant challenge lies in equipping future in-service science educators with the necessary competencies to bridge theoretical knowledge with practical applications. Addressing this gap is critical to ensuring that science educators can cultivate learners' investigative skills and empirical reasoning capabilities.

## CHALLENGES IN EXPERIENTIAL SCIENCE TEACHER EDUCATION

The inadequacies in pre-service secondary science teacher training in the Philippines are rooted in the lack of structured laboratory exposure. Many aspiring professional educators complete their baccalaureate program with limited proficiency in laboratory protocols, risk assessment, and safety management, impairing their ability to foster authentic scientific literacy (Obmerga, 2025; Obmerga & Yambao, 2025). While theoretical mastery is being ascertained in the Bachelor of Secondary Education (BSEd) major in science programs, experiential laboratory learning remains insufficient, creating a dissonance between content knowledge and practical application. As a result, novice science teachers struggle to implement hands-on, field-based, and inquiry-driven instruction essential for developing students' critical thinking and problem-solving skills (Almasri, 2024).

Reports from EDCOM II (2024; 2025) underscore that the absence of experiential learning exacerbates broader competency gaps in science education. Many Teacher Education Institutions (TEIs) fail to integrate practice-based learning in science effectively, producing graduates who are unprepared for real-world laboratory challenges and demands. Without substantial reforms prioritizing laboratory training, the cycle of

underprepared secondary science teachers will persist, ultimately weakening the country's science-related workforce. To enhance teacher effectiveness, experiential learning in laboratory courses must be treated as an essential component of the science teachers' professional training and formation.



**Figure 1.** *The Five Factor Dimensions of Safe Laboratory Teaching Praxis (SLTP)* (Obmerga, 2025)

While the Department of Education (DepEd) Order no. 48, series of 2006, outlines laboratory safety measures and competencies for in-service science educators, its scope does not extend to pre-service teachers, leaving a critical void in their laboratory preparedness. Although research-centric advancements in laboratory practices in medical industry and non-educational contexts are flourishing (Schröder et al., 2016), evidence-based practices on laboratory teaching competencies at the basic education level in both global north and south remain limited (Mohzana et al., 2023). Recent research efforts, such as the inquiry of Obmerga (2025), highlight the springboards for safe laboratory training among science teachers (See *Figure 1*). Such directives blend naturally with the existing Pre-service Teachers

Practice-based Training (PSTePT) Framework (See *Figure 2*) in the country, accentuating the integration of hands-on training within teacher preparation policy agenda, ensuring that future science teachers are equipped to foster functional science literacies and uphold safety standards in the laboratory context.



**Figure 2.** Pre-service Teachers Practiced-based Training (PSTePT) Framework (TEC – Philippine National Research Center for Teacher Quality, 2019)

## KEY POLICY GAPS

The Commission on Higher Education (CHED) Memorandum Order (CMO) no. 75, series of 2017, or the *Revised Policies, Standards, and Guidelines* (PSG) for BSEd, a legal instrument pursuant to the Republic Act no. 7722 or the *Higher Education Act of 1994*, remains the authoritative guide for TEIs in the Philippines. Thirteen years after the enactment of CMO no. 30, series of 2004, the *Revised Policies and Standards for Undergraduate Teacher Education Curriculum*, it dictates the technical parameters and key specifications of program offerings, curricular design, and technical compliance for the BSEd program, including science as a field of specialization.

A number of critical policy-related lapses may be spotted in the provisions that undermine the quality and efficacy of pre-service science teacher preparation in the country:

### 1. Deliberate Theoretical Concentration over Practical Training

Article IV, Section 7 prioritizes content mastery while overlooking the experiential learning necessary for laboratory-based instruction.

**Table 1.** The Program Outcomes of the BSEd major in science program

PROGRAM OUTCOME (PO)	DESCRIPTION
PO1	Demonstrate deep understanding of scientific concepts and principles
PO2	Apply scientific inquiry on teaching and learning
PO3	Utilize effective science teaching and assessment methods
PO4	Manifest meaningful and comprehensive pedagogical content knowledge (PCK) of the sciences

In *Table 1*, the Program Outcomes (PO) of the BSEd major in science focus on deepening theoretical instruction and enhancing pedagogical competence. However, while these outcomes emphasize content mastery and instructional methods, they do not explicitly highlight the laboratory-based skills crucial for pre-service science educators.

### 2. Undefined Laboratory Course Teaching-Learning Parameters

Article V, Section 9 mandates the specialization courses with laboratory components; however, there are no accompanying stipulations on resource allocation and instructional standards.

**Table 2.** The Specialization Courses with Laboratory Sessions in the BSEd major in Science Program Prospectus

COURSE TITLE	NUMBER OF LAB. UNIT(S)	LAB. CONTACT HOURS
Genetics	1	3
Cell and Molecular Biology	1	3
Microbiology and Parasitology	1	3
Anatomy and Physiology	1	3
Inorganic Chemistry	2	6
Organic Chemistry	2	6
Analytical Chemistry	2	6
Thermodynamics	1	3
Electricity and Magnetism	1	3
Waves and Optics	1	3

In *Table 2*, the BSEd major in science curriculum includes ten (10) specialization courses with laboratory components, each designed to develop the prospective science educators' technical competencies. However, the program prospectus lacks clear standards on laboratory design, instructional quality, and minimum required resources across the various branches of science covered in the laboratory coursework.

### 3. Absence of an Explicit Science Laboratory Infrastructure-related Provision

Article VI, Section 16 prescribes general physical resources to operate a teacher education program but fails to include a dedicated space for science laboratories.

**Table 3.** *The Physical Facilities Explicitly Prescribed in CMO 75, s. 2017 (PSG of the BSEd Programs in the Philippines)*

NON-SCIENCE PHYSICAL FACILITY	OPERATIONAL LEVEL
Information and Communications Technology Laboratory	
Speech Laboratory	Shared with other
Livelihood and Technology Laboratories/Shops <i>(Home Economics, Industrial Arts, Agriculture, Fisheries)</i>	Departments within the College/University

In *Table 3*, the required infrastructures for teacher education programs notably exclude specific science laboratories (e.g., general science, biological science, physical science, etc.).

### POLICY RECOMMENDATIONS

Given the actionable aspects unpacked in the prior segments of this Policy Brief and in consideration of the EDCOM II's (2025) projection that the Philippine baccalaureate program and policy standpoints are typically updated every 11 years, the following policy recommendations are proposed to be implemented by contemporary TEIs and incorporated in the next iteration of the PSG for BSEd major in science program in the Philippines:

#### A. PEDAGOGICAL DIRECTIONAL AREA

- Mandate periodic curriculum reviews among TEIs offering BSEd major in science programs to align laboratory teaching components with global standards
- Map the minimum laboratory instruction competencies that need to be mastered by the BSEd major in science students across the major branches of science
- Train pre-service science teachers with laboratory-based pedagogical approaches, strategies, and techniques under core science specialization courses in the BSEd major in science program
- Implement a competency-based laboratory practicum, guided by the PSTePT Framework, as a baccalaureate internship requirement
- Institute a strict internship auditing system, ensuring that the deployed graduating pre-service teachers have extensive laboratory exposure and hands-on training

- Develop an assessment framework for evaluating pre-service science teachers' laboratory skills prior to the conclusion of their semestral courses or formal internships

#### B. LEGAL DIRECTIONAL AREA

- Amend the CMO 75, s. of 2017, to:
  - Reframe the Program Outcomes and its specific Performance Indicators to emphasize not only content mastery but also experiential learning
  - Ensure specialization courses with laboratory components include specified hands-on teaching and learning training activities
  - Mandate the creation or conversion of existing infrastructures for science laboratory purposes exclusive to schools or colleges of education
  - Prescribe the minimum integrated and specialized science laboratory resources and teacher training requirements
  - Include laboratory competency assessments and continuous professional development for faculty members and cooperating/critic teachers (CT) handling pre-service science teachers, especially in the public school setting

#### C. OPERATIONAL DIRECTIONAL AREA

- Require TEIs to establish strong linkages with internship host schools and laboratory research-oriented institutions
- Establish a standardized accreditation system for science laboratory facilities in TEIs and internship host private and public schools
- Require TEIs and internship host schools to conduct joint laboratory capacity-building initiatives and programs
- Maximize the support extended by science faculty trainers from CHED Center of Excellence and Center of Development, prioritizing capacity-building initiatives for far-flung state/local colleges and universities (SUCs/LUCs)
- Provide government grants and incentives to TEIs and internship host schools to upgrade laboratory facilities and acquire modern equipment essential for pre-service science teacher training

#### FEASIBILITY ANALYSIS

Ensuring the successful implementation of the proposed policy recommendations necessitates a critical examination of their feasibility. This section assesses (a) *Financial Constraints*, (b) *TEI and Internship Host School Readiness*, and (c) *Regulatory Challenges* to determine the practicality of the proposed reforms in Filipino Science Teacher Education.



## A. FINANCIAL CONSTRAINTS

The establishment of general and specialized science laboratory facilities, procurement of modern laboratory equipment, and the enhancement of laboratory-based instructional system require significant financial investment. TEIs, particularly those in far-flung regions, may struggle to meet these demands without dedicated CHED and local government unit (LGU) funding. Grants and incentives can mitigate this challenge, but their availability and allocation remain uncertain. Furthermore, periodic curriculum reviews and competency assessments necessitates continuous monetary support for faculty training and accreditation processes. Without a clear funding mechanism, the long-term sustainability of these reforms is at risk.

## B. TEI AND INTERNSHIP HOST SCHOOL READINESS

Many TEIs and internship host schools, whether public or private in nature, lack the infrastructure and expertise to implement a hands-on laboratory training that meets global standards. The absence of standardized laboratory teaching and learning competency frameworks further complicates inconsistencies in pre-service science teacher preparation. While capacity-building initiatives and expert support from CHED Centers of Excellence and Development faculty trainers can bridge this gap, disparities in institutional readiness may persist, particularly in underfunded SUCs and LUCs. Strengthening institutional linkages with laboratory industry- and research-oriented institutions may address these deficiencies, but logistical and operational barriers proliferating at the macro- and micro-organizational scales, respectively, must be considered.

## C. REGULATORY CHALLENGES

Amending CMO no. 75, series of 2017, to integrate laboratory-specific mandates requires extensive policy deliberation and multi-stakeholder coordination. Resistance from institutions accustomed to traditional instructional models may impede progress. The implementation of mandatory laboratory competency assessments and internship audits also demands regulatory metrics to ascertain compliance and effectiveness without imposing excessive administrative burdens on TEIs and host schools. Additionally, faculty professional development requirements may encounter resistance due to workload constraints and limited incentives for continuing education.

Despite the feasibility challenges, a phased and multi-sectoral approach are essential to ensure that policy directives are both realistic and impactful. By implementing laboratory-related reforms gradually and fostering a collaborative stance among TEIs, regulatory bodies like CHED and DepEd, and

stakeholders, resource limitations and institutional drawbacks can be effectively managed. This strategic pacing allows for sustainable improvements in laboratory experiential learning among future science teachers while maintaining alignment with broader educational reform agendas of the country.

## CONCLUSION

As the Philippines strives for global competitiveness in the sciences, a fundamental transformation in the training of pre-service science teachers is imperative. The prevailing policy landscape, while emphasizing content mastery, has yet to fully integrate laboratory-based competencies as a core requirement, leaving previous and current cohorts of science teachers ill-equipped for the demands of hands-on, inquiry-driven laboratory instruction. Without strategic reforms, the disconnect between theoretical understanding and practical application will persist, weakening the country's ability to cultivate scientific literacy and innovation. By aligning science laboratory training with global standards, redefining curricular priorities, and institutionalizing structured laboratory practicum programs, the country can produce a generation of secondary science educators who are not only content experts but also proficient laboratory practitioners.

The recommendations outlined in this Policy Brief offer an insightful and actionable blueprint for strengthening Science Teacher Education in the Philippines. Mandating rigorous laboratory competency development, establishing dedicated infrastructure, and fostering institutional partnerships, among others, will ensure that pre-service science teachers gain the experiential expertise necessary for effective science instruction. Furthermore, embedding these reforms within CHED's regulatory frameworks and TEIs' operational mandates will pave the way for a culture of laboratory excellence—one that empowers science teachers, enriches student learning, and strengthens the scientific workforce of the future. By embracing these policy-oriented reforms, the Philippines can redefine the trajectory of Science Education and equip its primary agents with the tools to inspire the next generation of scientific thinkers and innovators.

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## Declaration

The authors received assistance from ChatGPT-40 in minimal grammar, syntax, and expression improvement revisions.



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## The PNU Educational Policy Research, and Development Office

The EPRDO is a specialized research center in the University focused on policy research and studies on teacher education. It is established to provide research-based policy recommendations to policy makers. It also serves as the clearing house for all data relevant to teacher education in the Philippines and beyond.

### Vision

The Philippine Normal University through the EPRDO aims to be an innovation hub of teacher education research and educational policy studies.

### Mission

To strengthen the culture of excellence in teacher education research and educational policy studies.

### Objectives

The EPRDO shall manage the University's research production, enhance human resource capabilities, and share expertise to other Teacher Education Institutions (TEIs) in the area of teacher education research

### Strategies

1. Establish and maintain a web-based university research portal that facilitates automated research management systems, and which also serves as the database of teacher education policies and teacher education research in the country and Southeast Asia.
2. Share research expertise and competence in teacher education research with other TEIs throughout the country;
3. Develop and disseminate the University research agenda
4. Design and implement the research capability program for faculty and staff;
5. Manage University's research production particularly the conduct of educational policy studies in education and teacher education; and
6. Serve as the implementing arm for research incentives and research ethics review.

### Values

SYNERGY (Working collaboratively as a team)  
 EFFICIENCY (Delivering research services efficiently)  
 EXCELLENCE (Achieving high quality research outputs)  
 PRODUCTIVITY (increasing research production of the University)



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