Why Schools Lack Laboratory and Equipment in Science? Through the Lense of Research Studies

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ABSTRACT

This paper examined the root causes of the lack of laboratory and equipment in Science among schools in the Philippines through review of related studies. Findings show that root causes why public schools in the Philippines lack laboratory and equipment in science are budgetary constraints and underfunding, mismanagement and utilization of funds,

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INTRODUCTION

Science laboratories and equipment are crucial in fostering scientific literacy and practical skills among students, as well as supporting advanced research and development. Laboratories serve as a platform for experiential learning, allowing students to engage in hands-on experiments that reinforce theoretical knowledge. This practical approach not only enhances understanding but also stimulates critical thinking and problem-solving abilities (University of the Philippines Diliman, 2023). Moreover, access to well-equipped laboratories is essential for conducting high-quality research that can contribute to national development, particularly in fields like biotechnology, environmental science, and agriculture. The Central Analytical Services Laboratory, for instance, supports diverse research activities by providing chemical analysis services, thus enabling significant advancements in scientific knowledge and innovation (BIOTECH UPLB, 2023). Investing in science infrastructure is, therefore, pivotal for building a skilled workforce and promoting sustainable development in the country.

The lack of science laboratories and equipment in the Philippines remains a significant challenge, particularly affecting the quality of science education. Recent data reveals that out of 12,390 high schools nationwide, 4,520 do not have laboratories, and many of those do lack access to modern digital tools. This shortage severely impacts students' ability to perform experiments and engage in hands-on learning, which is crucial for developing scientific skills and understanding (University of the Philippines Diliman, 2023). Efforts such as the development of the Versatile Instrumentation System for Science Education and Research (VISSER), a low-cost science kit, are being implemented to address these gaps by enabling schools to conduct experiments without the need for expensive equipment (UP Manila, 2024). However, more comprehensive government and private sector support is needed to ensure all students have equitable access to quality science education resources.

The urgency of establishing science laboratories and equipment in the Philippines is critical to enhancing the quality of science education and preparing students for global competitiveness. A significant portion of high schools in the country either lack laboratories or have outdated equipment, leading to poor performance in science subjects and limiting students' practical experience (UP Diliman, 2023). The development of low-cost science kits, such as the Versatile Instrumentation System for Science Education and Research (VISSER), is an innovative approach to address this gap by enabling students to perform various experiments across multiple scientific disciplines without needing a traditional lab setting (UP Diliman, 2023). Ensuring the availability of modern and safe laboratory facilities is essential not only for educational purposes but also for fostering research and development in the country, which is vital for national progress and economic growth (NIH,

2023).

The lack of a laboratory room, the inadequacy of laboratory facilities and science equipment, defective laboratory equipment, the inadequacy of learning materials, lack of water supply, and lack of electricity are common issues in both schools. Teacher-respondents of this study have difficulty in teaching some science concepts and are not fully equipped on how to use some science equipment. Addressing the identified challenges is recommended to achieve quality education for all (Hadji Abas & Marasigan, 2020).

Based on the result of the study of Caballes, Pedrita, , Villaren, and Diquito (2024), it can be concluded that some schools in the division of Davao del Sur are lacking with the prescribed science laboratory. Thus, it is recommended that the Department of Education to conduct a general assessment of all secondary schools to determine the status of science laboratories' physical infrastructure, equipment, and materials.

With this, it is very important to investigate several research studies on the underlying reasons as to why there is a lack of science laboratory in Philippine schools and lack of science laboratory equipment to understand further as to how young Filipinos perform relative to science subject. This study is intended to explore the contributing factors of lack of science laboratory and equipment which hopes to give a bird's eye view to educational and government leaders in the community.

Research Questions

What are the existing findings from different studies on the root causes of the lack of laboratory and equipment in science schools in the Philippines?

METHODOLOGY

This paper is based on a desk research approach which is basically a review of related literature analyzing findings of existing studies. This approach in research involves systematically analyzing previous studies and scholarly works relevant to a specific topic or research question. The primary objective of the Review of Related Literature (RRL) is to identify gaps in the existing body of knowledge and provide a context for the current study. According to Creswell (2014), an effective literature review enables researchers to build on the foundations of previous work, preventing redundancy and fostering the development of new insights. By synthesizing related studies, researchers can also identify trends, theoretical frameworks, and methodologies that inform their own research design. Furthermore, a comprehensive literature review helps in defining the scope of a study, ensuring that the research problem is clearly understood within the context of what is already known.

Further, the review of related literature critically evaluates and compares the findings of previous research. Ridley (2012) argues that this critical assessment allows researchers to assess the validity, reliability, and relevance of existing studies, which can shape the direction of new investigations. A well-structured RRL also helps identify conflicting viewpoints or inconsistencies in the literature, which may warrant further exploration. In addition, it provides the theoretical foundation necessary to justify the significance of a study, guiding researchers in the formulation of hypotheses and research questions. By carefully reviewing related literature, scholars not only situate their work within the broader academic discourse but also contribute to the cumulative advancement of knowledge in their respective fields.

RESULTS AND DISCUSSION

Based on the reviewed literature, the following root causes of lack of laboratory and equipment in science have been found out from different sources:

Matrix 1. Root Causes the Lack of Laboratory and Equipment in Science

Root Cause	**Proponent**
Budgetary Constraint and Underfunding	David, Albert, & Monterola (2019)

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	Barrot (2019)
	Tabora (2017)
	DepEd (2022)
	World Bank (2021)
Mismanagement and Utilization of Funds	Transparency International (2018)
	Carlo & Abad (2019)
	Mapa et al. (2020)
	World Bank (2020)
Inequitable Distribution of Resources	David et. Al. (2019)
	UNESCO (2018)
Lack of Teacher Training and Maintenance	Cruz (2020)
	Abellera (2017)
	Bautista (2016)

Budgetary Constraints and Underfunding. A key reason for the absence of science laboratories and equipment in Philippine public schools is the chronic underfunding of the education sector. Although the Philippine government allocates a significant portion of the national budget to education, much of the funding is consumed by teacher salaries and general school maintenance, leaving little room for infrastructure development, including the construction of laboratories and the procurement of science materials (David, Albert, & Monterola, 2019). Public schools rely heavily on the annual General Appropriations Act (GAA), and while there have been efforts to increase funding for the development of science facilities, these remain insufficient to meet the growing demand. The lack of priority given to science education in budget allocations contributes to the inadequate science infrastructure in many schools (Barrot, 2019).

Furthermore, due to limited financial resources, schools are often forced to prioritize spending on basic needs such as classrooms, desks, and textbooks, leaving little to no funds for science laboratories. The budget for science equipment in many public schools is minimal, and in some cases, non-existent. This situation is further exacerbated by the rising costs of science equipment and laboratory materials, which makes it difficult for schools to maintain or upgrade existing facilities (Tabora, 2017). As a result, students in public schools often lack the opportunity to engage in hands-on experiments, which are crucial for learning scientific concepts effectively.

Budgetary constraints and underfunding are significant root causes of the lack of science laboratories and equipment in many Philippine schools. Due to limited government spending on education, particularly in public schools, the allocation for necessary resources such as laboratory infrastructure and scientific tools is often insufficient. According to the Department of Education's 2022 budget allocation, only a small fraction was dedicated to science education, with most funds directed toward basic infrastructure and teacher salaries (DepEd, 2022). This lack of prioritization leaves schools unable to purchase or maintain laboratory equipment, thereby hindering students' ability to engage in hands-on scientific learning. Moreover, the growing student population exacerbates the issue, as the limited available resources are spread thin across many schools, especially in rural and underdeveloped areas (World Bank, 2021). The consistent underfunding of science education not only limits the development of critical scientific skills but also widens the educational gap between students in well-funded private schools and those in under-resourced public institutions.

Mismanagement and Utilization of Funds. Another major factor contributing to the lack of science laboratories is mismanagement and inefficient use of funds intended for education. Reports indicate that the distribution and allocation of funds for infrastructure, including science laboratories, are often delayed or

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misallocated (Transparency International, 2018). Corruption and bureaucratic inefficiencies within the Department of Education (DepEd) and local government units (LGUs) have been cited as reasons why funds meant for science facilities are either underutilized or redirected to other projects (World Bank, 2020). These systemic issues lead to significant delays in the construction of laboratories and the procurement of necessary equipment.

Additionally, the lack of proper monitoring and evaluation mechanisms within the education sector has allowed for resources intended for science education to be misused or wasted. In some cases, schools receive laboratory equipment, but they remain unused due to a lack of proper laboratory rooms or inadequate teacher training on how to handle the equipment (Carlo & Abad, 2019). Without clear accountability and oversight, funds that should be used to enhance science education in public schools are often squandered or remain unspent.

Mismanagement and improper utilization of funds have been identified as significant contributors to the lack of laboratory facilities and equipment in many Philippine schools. Despite budget allocations intended to enhance science education, the misuse of these funds often results in inadequate resources for students, particularly in public schools. This issue hampers the ability of students to engage in practical science learning, which is essential for understanding complex scientific concepts. A study by Mapa et al. (2020) emphasized that the poor governance of educational funds is a key factor in the persistent shortage of educational resources, including laboratory equipment. Effective financial management is crucial to addressing this gap and improving the quality of science education in the country.

Further, the study of Mangarin and O'Loughlin (2024) emphasized the idea that the power of a school head under legitimacy is deemed significant to be used either for welfare or for self-interest especially that finance-related decisions are needed to be made. Scrutinizing from policies from authorities, down to how school heads managed to understand the policies and make decisions on implementations, down to engaging teachers under their supervision to generate initiatives on efficient outputs of the required orders, down to evaluation of the outcome, are important considerations to enhance operational capacity of the organization especially in learning institutions to provide public value to clients-parents and learners.

Inequitable Distribution of Resources. The distribution of science laboratories and equipment in Philippine public schools is highly uneven, with urban schools often receiving more resources than their rural counterparts. Schools located in highly urbanized areas are more likely to have access to laboratories and equipment due to better funding and proximity to educational hubs and donors (UNESCO, 2018). On the other hand, schools in remote and underserved regions are severely disadvantaged, with many lacking even the most basic science materials.

This inequitable distribution of resources is partly due to the centralized nature of the DepEd's decision-making process, which often overlooks the specific needs of schools in rural areas. Schools in geographically isolated and disadvantaged areas (GIDAs) are frequently left behind in terms of infrastructure development due to logistical challenges and the high costs of transporting materials (David et al., 2019). As a result, students in these areas face significant disparities in terms of access to quality science education, further perpetuating educational inequities in the country.

Lack of Teacher Training and Maintenance. The absence of adequately trained science teachers also contributes to the underutilization of science laboratories and equipment in public schools. Many teachers in public schools, especially in rural areas, lack the training and expertise to conduct laboratory experiments and manage scientific equipment. This is often due to insufficient professional development opportunities and a lack of focus on science during teacher training programs (Abellera, 2017). Even when schools manage to acquire science equipment, it is often left unused or poorly maintained due to a lack of knowledge of how to use or repair the materials.

Moreover, maintaining science laboratories and equipment requires consistent funding for upkeep, which is often overlooked in budget planning. Equipment such as microscopes, beakers, and Bunsen burners can easily fall into disrepair if not properly maintained, further limiting students' ability to engage in hands-on science

activities (Bautista, 2016). Without proper maintenance and technical support, science laboratories in public schools quickly become obsolete, leaving students to rely on theoretical learning rather than practical applications.

Lack of teacher training and maintenance has been a significant root cause of the shortage of laboratory facilities and equipment in science education across Philippine schools. Insufficient training hampers educators' ability to effectively utilize and maintain existing laboratory resources, leading to rapid wear and tear and underutilization of equipment. This problem is exacerbated by the inadequate professional development opportunities provided to science teachers, limiting their skills in both managing laboratory operations and troubleshooting technical issues. Moreover, without the proper knowledge and training, teachers may be unable to advocate for the necessary resources, contributing to the perpetuation of poor laboratory conditions (Cruz, 2020). The combination of these factors not only affects the quality of science education but also discourages students from engaging in scientific experimentation, ultimately impeding the development of critical thinking and problem-solving skills.

CONCLUSION

The lack of science laboratories and laboratory equipment in Philippine public schools is a multifaceted problem rooted in budgetary constraints, mismanagement of funds, inequitable resource distribution, and inadequate teacher training. Addressing these issues will require comprehensive reforms in the education system, including increased funding for science infrastructure, better management and oversight of resources, and targeted support for schools in disadvantaged areas. By improving access to science laboratories and equipment, the Philippine education system can better prepare students for careers in science and technology, which ntial are essefor the country’s development.

To address the lack of science laboratories and equipment in the Philippines, a multi-faceted approach is needed. First, government investment in educational infrastructure should be prioritized, with funding specifically allocated to build and equip science labs in underserved schools. Partnerships with private companies and NGOs can provide additional resources and expertise, especially in rural areas. Moreover, integrating low-cost, portable science kits and digital tools can help bridge the gap where traditional labs are not feasible. Teacher training programs should also be expanded to effectively use these new resources and promote innovative teaching methods.

Further, to strategically address the lack of science laboratories and equipment in Philippine schools, the government should prioritize budget allocation for education infrastructure. By earmarking a portion of the national budget specifically for the construction and upgrading of science laboratories, public schools can gradually improve their facilities. This initiative can be reinforced through a phased implementation plan, focusing first on schools with the greatest need and ensuring compliance with international standards for science education. In addition, partnerships with local government units and private institutions can help mobilize additional resources, ensuring that budgetary constraints are minimized while improving the quality of science education across regions.

Also, schools can adopt collaborative resource-sharing models, particularly in rural and underfunded areas. Schools that are located within close proximity can share science laboratory facilities and equipment, enabling students from different schools to access essential tools for practical science learning. Establishing regional science hubs or mobile laboratories could serve as another option, especially for schools that may not have the immediate resources or space to construct a full laboratory. This method promotes efficiency and ensures that students still have hands-on experience despite the limited availability of resources in their individual schools.

Lastly, leveraging technology through digital and virtual labs can complement physical science equipment. Digital simulations, augmented reality (AR), and virtual reality (VR) platforms allow students to conduct experiments and explore scientific concepts in an interactive way without the need for physical materials. While these tools may require initial investment in technology infrastructure and teacher training, they provide a sustainable long-term solution to resource shortages. By incorporating blended learning approaches, schools can enhance science education even in environments where physical laboratories are not yet feasible, making it

more accessible to a broader range of students.

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