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Research Article

Status of Laboratory Resources and Teaching Competence in Schools Division of Ilocos Norte

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ABSTRACT

This study examined the status of laboratory resources in public secondary schools in Ilocos Norte and evaluated science teachers' laboratory competence. Using a descriptive survey design, the study involved 198 science teachers, selected through total enumeration method. Conducted in October 2024 at all public secondary schools in the Schools Division of Ilocos Norte, data were collected using a survey questionnaire instrument and analyzed using frequency count, percentages, and mean for the availability and accessibility of laboratory equipment and facilities and the level of laboratory competence of teachers. Key areas investigated included the accessibility of laboratory facilities and equipment, the presence of laboratory technicians, and teachers' proficiency in laboratory knowledge and instructional skills. Results revealed significant gaps in providing advanced laboratory apparatus, although basic equipment was relatively accessible. Science teachers demonstrated average competence, but challenges such as insufficient resources, inadequate training, and poor facility maintenance impeded optimal instruction. Notable constraints included infrastructure issues, unequal resource distribution, and limited professional development opportunities. The findings highlight the need for equitable resource allocation and enhanced competencies to improve the quality of science instruction. Recommendations include regular professional development, improved resource accessibility, and institutional support to foster innovative teaching practices.

Keywords: *Science, Physics, Science teachers, Knowledge, Competence, Skills, Laboratory equipment and facilities*

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Background

In science education, where practical experience is critical for effective learning, laboratory resources, and teaching competence play a vital role. Adequate laboratory resources/ equipment is fundamental to successfully implement the curriculum and enabling thorough investigations of science principles (Timbasal - Nuevo, 2024). Furthermore, ongoing training and support equip teachers to effectively utilize the resources, thereby enhancing teaching effectiveness and teachers' ability to organize and execute laboratory activities significantly impacts student engagement and learning outcomes (Supriyatman et al., 2024).

Building on this, instructional practices aligned with quality standards have been shown to boost student performance and engagement (Meng, 2023). SDG 4, as highlighted by Ryan and Dola (2024), emphasizes removing barriers to education and ensuring that all children, regardless of gender or socioeconomic background, receive high-quality education. This goal is interconnected with other Sustainable Development Goals, as high-quality education fosters essential skills for global citizenship and sustainable development (Huang et al., 2024).

Contradicting conventional perceptions, research conducted in Indonesia revealed that students in private schools outperformed their peers in public schools on biology tests, despite having fewer laboratory resources. This finding underscores that while laboratory facilities are vital, their perceived importance does not always guarantee success in the classroom (Haedar et al., 2024).

In the Philippines, particularly in rural regions, the lack of sufficient laboratory equipment limits opportunities for practical scientific experimentation. Teachers often resort to in-class demonstrations as an alternative to hands-on activities due to these limitations (Pacadaljen, 2024). Financial mismanagement and budgetary constraints are identified as key contributors to the shortage of laboratory resources in public schools (Mangarin & Macayana, 2024). In response, the Department of Education has been implementing plans to enhance science instruction, especially given the low performance of Filipino students in international assessments like PISA (Silver–Banito, 2022).

Effective teaching necessitates a diverse skill set, and Filipino pre-service teachers have shown strong proficiency in both content and skills competence (Cruzata, 2023). To further improve teaching quality, the Philippine Professional Standards for Teachers (PPST) aim to ensure adherence to international teaching methodologies (Malunes & Dioso, 2020).

Teachers in Ilocos Norte face specific challenges due to insufficient laboratory supplies, often conducting experiments in classrooms rather than in proper laboratory settings (Pacadaljen, 2024). This lack directly impacts their ability to facilitate practical experiments, particularly in subjects such as biology, chemistry, and earth science (Timbasal – Nuevo, 2024). Beyond restricting hands-on learning, inadequate resources also diminish student performance in science. Additionally, studies reveal that science teachers in Ilocos Norte often exhibit low proficiency in evaluation techniques, further influencing teaching quality (Antonio et al., 2024). Teachers have reported time constraints and insufficient training in modern assessment methods as significant barriers, complicating their instructional strategies. Timbasal–Nuevo (2024) underscores that both enhancing teacher skills and providing sufficient resources are essential for improving educational outcomes.

Addressing these gaps is vital for advancing science education. Insufficient laboratory resources hinder hands-on scientific experimentation, which is crucial for student engagement and comprehension of scientific principles. In resource-poor settings, teachers often resort to alternative instructional methods like demonstrations and multimedia presentations to compensate for the lack of resources (Pacadaljen, 2024). The availability of resources significantly impacts teaching quality, as the absence of adequate support makes it challenging for educators to sustain instructional effectiveness (Cabural, 2024). While the interplay between resource adequacy and teaching competence is crucial, limited studies have explored this relationship within Ilocos Norte (Mohapatra et al., 2019).

This study seeks to address this critical gap, focusing on laboratory resources and teaching proficiency in the local context of Ilocos Norte. Examining how the shortage of laboratory resources/equipment limits practical scientific experimentation, emphasizes the importance of raising student interest and comprehension of scientific concepts. The study highlights educators' resilience and creativity in adapting to resource constraints, utilizing alternative methods like multimedia presentations and demonstrations. Its findings aim to contribute to the existing body of knowledge, providing practical insights into laboratory resource allocation, optimizing teaching strategies, and informing educational policies. Ultimately, the study strives to enhance the quality of education both locally and nationally.

Methods

Study Design

This study evaluated the state of laboratory resources in public secondary schools and investigated the laboratory competence of science teachers using a descriptive survey design. Descriptive analysis was used to assess teachers' knowledge and skills in laboratory instruction as well as the accessibility and availability of laboratory facilities and equipment. To show the current state of laboratory-based teaching practices and the knowledge and skills competence of teachers in laboratory instruction, the study used survey methods to gather complete data.

Participants and Setting

The study was conducted in the Schools Division of Ilocos Norte and targeted all junior and senior high school science teachers currently employed in public secondary schools within the division. To guarantee thorough population representation, a total enumeration approach was applied, including all science teachers. A full and accurate representation of the target demographic was ensured by the inclusion of 198 science teachers in the overall population as of the study period.

Data Collection Instruments

The researcher used a two-part survey instrument. The survey covered the availability of laboratory resources, and teachers' competence in knowledge and skills.

The first part investigates the status of laboratory facilities, equipment, and technicians present in every schools. Tools for evaluation were adapted from DepEd Guidelines for the Provision of Science and Mathematics Equipment (DO #17, s. 2017), DepEd Guidelines for the Prescribed Science Laboratory School Facilities (DO #4, s. 2006), and World Health Organization Laboratory Standards and Their Quality Implementation. These materials explicitly venture to understand the state of laboratories in the division. For the teachers' level of competence, the material was adopted from the tool used by Gecer and Zengin (2016). It seeks to understand the competence level of teachers in terms of knowledge and skills in using and providing laboratory instruction.

To ensure the validity of the instrument, it underwent expert validation. A panel of three (3) experts in science education and research methodology reviewed the instrument for clarity, content relevance, and alignment with the study objectives, ensuring its appropriateness for data collection.

Data Gathering Procedures

After obtaining approval from the Schools Division Superintendent and University Research Ethics Review Board, surveys were distributed in both printed and online formats. Participants were given a week to respond, ensuring minimal disruption to their teaching schedules. To maximize participation, the survey link was shared through the official Schools Division Facebook page.

Data Analysis

Laboratory resource availability and teacher competence were assessed by using frequency counts, percentages, and means for the quantitative data. The data analysis was conducted within the aid of Microsoft Excel, which ensured accurate computation and effective presentation of results.

Ethical Issues

Ethical approval was sought to ensure that the study was conducted according to research ethics standards. Participants were asked to give their informed consent and were assured of anonymity and confidentiality of their responses. Data used for research purposes were destroyed after completion of the study.

Result and Discussion

Availability of Laboratory Apparatus and Facilities

Laboratory equipment and facilities availability is very fundamental to efficient science instruction. Table 1 summarizes the provision of laboratory apparatus and facilities in public secondary schools within Ilocos Norte. This reveals some salient gaps in the provision of the resources as compared to others where the more sophisticated instruments for performing more complex scientific experiments are better accessible than the simpler ones.

Table 1. Availability of Laboratory Apparatus and Facilities

Laboratory Apparatus				
Name of Apparatus	**Available**		**Unavailable**	
	Frequency	Percentage	Frequency	Percentage
Advanced Electromagnetism Kit	33	21.57	33	21.57
Air Blower	20	13.07	46	30.07
Alcohol Burner	64	41.83	2	1.31
Ammeter	49	32.03	17	11.11
Archimedes Principle Set	27	17.65	39	25.49
Astronomy Multimedia Package	29	18.95	37	24.18
Ball Peen Hammer	15	9.80	51	33.33
Basic Electronics Kit	54	35.29	12	7.84
Basic Lens Set	55	35.95	11	7.19
Beaker	66	43.14	0	0
Bunsen Burner	57	37.25	9	5.88
Calorimeter	25	16.34	41	26.80
Centrifuge	21	13.73	45	29.41
Coefficient of Linear Expansion	7	4.58	59	38.56
Compound Microscope	62	40.52	4	2.61
Condenser	27	17.65	39	25.49
Conical Flask	29	18.95	37	24.18
Cork Stopper	58	37.91	8	5.23
Crucible	51	33.33	15	9.80
DC String Vibrator	25	16.34	41	26.80
Diffraction Grating Set	23	15.03	43	28.10
Digital Geiger-Muller Counter	14	9.15	52	33.99
Digital Microscope	21	13.73	45	29.413
Distilling Flask	53	34.64	13	8.50
Dry Cell	53	34.64	13	8.50
Dry Cell Holder	50	32.68	16	10.46
Electrolysis Apparatus	29	18.95	37	24.18
Electronic Balance	20	13.07	46	30.07
Engine Model	12	7.84	54	35.29
Erlenmeyer Flask	66	43.14	0	0
Evaporating Dish	63	41.18	3	1.968
Filter Paper	56	36.60	10	6.54
Flat-bottomed Flask	37	24.18	29	18.95

Laboratory Apparatus				
Name of Apparatus	Available		Unavailable	
	Frequency	Percentage	Frequency	Percentage
Florence Flask	55	35.95	11	7.19
Force Table	23	15.03	43	28.10
Fuse and Fuse Holder	30	19.61	36	23.53
Galvanometer	38	24.84	28	18.30
Glass Funnel	61	39.87	5	3.27
Glass Slides	62	40.53	4	2.617
Glass Tubing	47	30.72	19	12.41
Graduated Cylinder	66	43.14	0	0
Graduated Pipette	53	34.64	13	8.50
Halogen Tube	11	7.19	55	35.95
Hand Lens	55	35.95	11	7.19
Hot Plate	37	24.18	29	18.95
Hydrometer	19	12.41	47	30.72
Iron Clamp, Ring, and Stamp	54	35.29	12	7.84
Laboratory Oven	5	3.27	61	39.87
Laser Light	32	20.92	34	22.22
Light Bulb	53	34.64	13	8.50
Loudspeaker	15	9.80	51	33.33
LPG Tank	19	12.42	47	30.72
Magnesium Ribbon	25	16.34	41	26.80
Magnetic Stirrer	18	11.76	48	31.37
Mechanical Wire Cutter	17	11.11	49	32.03
Mirror Set	42	27.45	24	15.69
Motor-Generator Model Set	33	21.57	33	21.57
Multimeter	42	27.46	24	15.67
Open U-Tube Manometer	19	12.42	47	30.72
Optical Bench Set	21	13.73	45	29.41
Power Supply	51	33.33	15	9.80
Precision Screwdriver Set	15	9.80	51	33.33
Prism	47	30.72	19	12.42
Resistance Board	23	15.03	43	28.10
Ripple Tank Set	20	13.07	46	30.07
Screwdriver	39	25.49	27	17.65
Soldering Iron	25	16.34	41	26.80
Sound Signal Generator Kit	11	7.19	55	35.95
Speedometer	27	17.65	39	25.49
Spring Balance	52	34	14	9.15
Stirring Rod	62	40.52	4	2.61
Strobe Light	22	14.38	44	28.76
Switches	42	27.45	24	15.69
Syringe	55	35.95	11	7.19
Telescope	23	15.039	43	28.109
Test Tube	66	43.14	0	0
Thermometer	63	41.18	3	1.98
Triple Beam Balance	63	41.18	3	1.968

Laboratory Apparatus				
Name of Apparatus	Available		Unavailable	
	Frequency	Percentage	Frequency	Percentage
Tripod	65	42.488	1	0.65
Tuning Fork	52	34	14	9.15
Vacuum Tube	19	12.42	47	30.72
Voltmeter	37	24.182	29	19
Yeast	15	9.80	51	33.33

Laboratory Facilities				
Name of Apparatus	Available		Unavailable	
	Frequency	Percentage	Frequency	Percentage
Air Conditioning Unit	28	18.30	38	24.84
Benches	36	23.53	30	19.61
Cabinet	66	43.14	0	0
Dark Room	9	5.88	57	37.25
Electric Fans	62	40.52	4	2.61
Electricity	62	40.52	4	2.61
Fire Extinguisher	53	34.64	13	8.50
First Aid Kit	60	39.22	6	3.92
Shower Room	29	18.95	37	24.18
Sinks	50	32.68	16	10.46
Storage Room	47	30.72	29	18.95
Water Supply	51	33.33	15	9.80

Table 1 shows adequate equipment and facilities of respective laboratories stationed in public secondary schools in the Schools Division of Ilocos Norte but serious deficiencies in stock in terms of access in a table format. ETI employs common lab equipment — beakers, Erlenmeyer flask, graduated cylinders. The inventory was thus found for all these materials at 43.14%, so it can respectively invest a minimum in access to a laboratory document in each of the schools. On the other hand, some of the equipment like Advanced Electromagnetism Kit and Digital Geiger-Muller Counter are highly in shortage with 21.57% and 9.15% availability respectively. Thus, these findings point to inequities in resource availability, especially for generative, scientific experimentation.

Also, educational lab tools are not specialized, making it difficult for teachers to develop extensive laboratory activities, which can limit students' understanding of more sophisticated scientific concepts. As pointed out by other researchers, poor availability of laboratory resources are associated with lower engagement among students and understanding of abstract scientific concepts as well as missing critical opportunities for practical application of theoretical knowledge, which is essential for grasping scientific principle (Pacadaljen, 2024). The shortfall in availability of such resources highlights the necessity of research about accessibility of laboratory facilities in schools.

Accessibility of Laboratory Apparatus and Facilities

Accessibility is an important variable that decides whether the available resources are being optimally used. Table 2 shows the average accessibility ratings for laboratory apparatus and facilities. This is a measure that shows extreme variability, where elementary tools are frequently accessible but more sophisticated equipment remains inaccessible to most of the teachers and learners.

Table 2. Accessibility of Laboratory Apparatus and Facilities

Laboratory Apparatus		
Name of Apparatus	**Mean**	**Descriptive Interpretation**
Advanced Electromagnetism Kit	2.17	Rarely
Air Blower	2.00	Rarely
Alcohol Burner	3.08	Sometimes
Ammeter	2.53	Rarely
Archimedes Principle Set	1.89	Rarely
Astronomy Multimedia Package	2.29	Rarely
Ball Peen Hammer	1.92	Rarely
Basic Electronics Kit	2.73	Sometimes
Basic Lens Set	3.05	Sometimes
Beaker	3.88	Often
Bunsen Burner	2.76	Sometimes
Calorimeter	1.85	Rarely
Centrifuge	1.80	Never
Coefficient of Linear Expansion	1.53	Never
Compound Microscope	3.76	Often
Condenser	2.11	Rarely
Conical Flask	1.94	Rarely
Cork Stopper	2.71	Rarely
Crucible	2.58	Raely
DC String Vibrator	1.95	Rarely
Diffraction Grating Set	1.85	Rarely
Digital Geiger-Muller Counter	1.68	Never
Digital Microscope	2.00	Rarely
Distilling Flask	2.48	Rarely
Dry Cell	2.80	Sometimes
Dry Cell Holder	2.65	Sometimes
Electrolysis Apparatus	2.02	Rarely
Electronic Balance	2.02	Rarely
Engine Model	1.73	Never
Erlenmeyer Flask	3.14	Sometimes
Evaporating Dish	3.26	Sometimes
Filter Paper	3.21	Sometimes
Flat-bottomed Flask	2.23	Rarely
Florence Flask	2.50	Rarely
Force Table	1.98	Rarely
Fuse and Fuse Holder	2.09	Rarely
Galvanometer	2.05	Rarely
Glass Funnel	3.05	Sometimes
Glass Slides	3.52	Often
Glass Tubing	2.27	Rarely
Graduated Cylinder	3.68	Often
Graduated Pipette	2.64	Sometimes
Halogen Tube	1.68	Never
Hand Lens	3.11	Sometimes
Hot Plate	2.29	Rarely

Laboratory Apparatus		
Name of Apparatus	**Mean**	**Descriptive Interpretation**
Hydrometer	1.76	Never
Iron Clamp, Ring, and Stamp	2.62	Sometimes
Laboratory Oven	1.61	Never
Laser Light	2.38	Rarely
Light Bulb	3.11	Sometimes
Loudspeaker	2.12	Rarely
LPG Tank	1.77	Never
Magnesium Ribbon	1.97	Rarely
Magnetic Stirrer	1.79	Never
Mechanical Wire Cutter	1.92	Rarely
Mirror Set	2.82	Sometimes
Motor-Generator Model Set	2.09	Rarely
Multimeter	2.30	Rarely
Open U-Tube Manometer	1.77	Never
Optical Bench Set	1.86	Rarely
Power Supply	3.27	Sometimes
Precision Screwdriver Set	1.88	Rarely
Prism	2.86	Sometimes
Reagent Bottle	2.68	Sometimes
Resistance Board	1.98	Rarely
Resonance Tube	1.71	Never
Ripple Tank Set	1.85	Rarely
Screwdriver	2.56	Rarely
Soldering Iron	2.03	Rarely
Sound Signal Generator Kit	1.76	Never
Speedometer	2.12	Rarely
Spring Balance	2.67	Sometimes
Strobe Light	1.85	Rarely
Switches	2.67	Sometimes
Syringe	3.26	Sometimes
Telescope	2.02	Rarely
Test Tube	3.88	Often
Thermometer	3.80	Often
Tong	3.61	Often
Triangular File	2.14	Rarely
Triple Beam Balance	3.26	Sometimes
Tripod	3.27	Sometimes
Tuning Fork	2.59	Rarely
Vacuum Tube	1.83	Rarely
Yeast	2.02	Rarely

Laboratory Facilities		
Name of Facilities	**Mean**	**Descriptive Interpretation**
Air Conditioning Unit	2.14	Rarely
Benches	2.91	Sometimes
Cabinet	4.33	Always

Laboratory Facilities		
Name of Facilities	**Mean**	**Descriptive Interpretation**
Dark Room	1.76	Never
Electric Fans	4.35	Always
Electricity	4.45	Always
Fire Extinguisher	2.82	Sometimes
First Aid Kit	3.68	Often
Shower Room	2.32	Rarely
Sinks	3.48	Often
Storage Room	3.30	Sometimes
Water Supply	3.91	Often

Legend: 4.20-5.00 (Always); 3.40-4.19 (Often); 2.60-3.39 (Sometimes); 1.81-2.59 (Rarely); 1.00-1.80 (Never)

Table 2 investigates the accessibility of available laboratory resources. The items included in this table were test tubes, microscopes, and graduated cylinders. These items have a mean score of "often accessible" because the means are 3.88, 3.76, and 3.68, respectively. This indicated that basic tools are incorporated into teaching practices. However, the Centrifuge, for instance, was reported as "rarely" or "never accessible" (mean = 1.80) while the Digital Microscope was rated with a mean of 2.00 on the same line.

The inaccessibility of advanced equipment can be attributed to inadequate quantities, lack of maintenance, and not enough teacher training. For instance, apparatuses that are required for the performance of advanced experiments, such as diffraction gratings and spectroscopy kits, are underutilized, thereby limiting the laboratory work. The differences in availability highlight systemic issues, including a lack of equity in funding and inadequate support for infrastructure in science education. According to Efendi and Jayanti (2024) and Odunayo (2024), conducting accessibility audits helps identify usability issues that may hinder effective learning and research activities as well as these audits can lead to targeted improvements, ensuring that all users, including those with disabilities, can effectively utilized laboratory resources.

Knowledge Competence of Teachers in Science Laboratory

Teachers' knowledge competency is also important to make the most out of the utilization of laboratory resources. Table 3 outlines the teachers' knowledge level regarding laboratory methods and safety measures. Though the study shows that teachers have sound theoretical knowledge, the lack of knowledge regarding modern tools of laboratories must be bridged by designing training programs accordingly.

Table 3. Knowledge Competence of Teachers in Science Laboratory

Statement	Mean	Descriptive Interpretation
I know the importance of laboratory methods in science teaching.	4.53	Strongly Agree
I know teaching methods and techniques that are used in laboratory studies.	4.27	Strongly Agree
I have all the knowledge to create a safe working environment in the laboratory.	3.98	Agree
I know all the tools in the science lab.	3.50	Agree
I have the knowledge related to simple maintenance equipment in the laboratory.	3.86	Agree

Statement	Mean	Descriptive Interpretation
I have the knowledge of measuring students' knowledge and skills related to laboratory work.	4.05	Agree
I have the knowledge of measuring students' attitudes regarding their laboratory studies.	4.03	Agree
I know how to select the appropriate tools for a given experiment.	4.11	Agree
I know how to follow safety rules when using equipment.	4.33	Strongly Agree
I know how to interpret test results.	4.14	Agree
Weighted Mean	**4.08**	**Agree**

Legend: 4.20-5.00 (Strongly Agree); 3.40-4.19 (Agree); 2.60-3.39 (Somewhat Agree); 1.81-2.59 (Disagree); 1.00-1.80 (Strongly Disagree)

Table 3 indicates that the knowledge competency of teachers in performing laboratory-based science instruction is very high. The mean score for statements such as "I know the importance of laboratory methods in science teaching" was 4.53 ("Strongly Agree"), and knowledge on appropriate safety measures also scored high, which suggests that teachers are aware of critical laboratory practices. Findings reveal that teachers have a good theoretical basis to carry out laboratory instruction effectively.

According to Zabala and Dayaganon (2023), there is a lack of confidence and competence when using sophisticated laboratory equipment. Due to these limitations, there were less possibilities for practical experience, which led to deficiencies in science process skills. Lower skill levels were seen when using complex tools ass digital microscopes and spectrophotometers, highlighting the necessity of hands-on experience. This is consistent with Bandura's Self-Efficacy Theory, which holds that confidence and competency in the execution of a given task are dependent on the resources available and the opportunities for the building up of competencies. Closing these gaps by providing competency-based training and workshops to teachers can enable them to better exploit advanced laboratory tools, thus enhancing learning.

Competence Skills of Teachers in Science Laboratory

Competence skills empower teachers with the ability to deliver laboratory-based instruction effectively. Table 4 details the self-assessed competency of teachers regarding different laboratory procedures. The statistics indicate that even though teachers are qualified in maintaining the safety standards and handling basic instruments, there is a requirement for upgrading their competence in the handling of sophisticated apparatus to enhance quality instruction.

Table 4. Competence Skills of Teachers in Science Laboratory

Statement	Mean	Descriptive Interpretation
I can use appropriate teaching methods and techniques in laboratory studies.	4.18	Agree
I can create and maintain a safe working environment in the laboratory.	4.30	Strongly Agree
I can use all the tools in the science lab.	3.32	Somewhat Agree
I can execute simple laboratory equipment maintenance.	4.11	Agree
I can organize an effective teaching environment in the laboratory.	4.17	Agree

Statement	Mean	Descriptive Interpretation
I can develop and use simple tools for laboratory works.	4.12	Agree
I follow safety rules when doing laboratory activities.	4.36	Strongly Agree
I can interpret test results.	4.15	Agree
I can combine experimental results with theoretical knowledge to achieve new result.	4.05	Agree
I can execute science skills well.	4.00	Agree
Weighted Mean	**4.08**	**Agree**

Legend: 4.20-5.00 (Strongly Agree); 3.40-4.19 (Agree); 2.60-3.39 (Somewhat Agree); 1.81-2.59 (Disagree); 1.00-1.80 (Strongly Disagree)

The data in Table 4 reveal that teachers exhibit overall competency in performing various laboratory-related tasks, as evidenced by a weighted mean of 4.08, interpreted as “Agree.” Teachers strongly agreed (mean = 4.36) that they follow safety rules when conducting laboratory activities, indicating a strong commitment to creating a safe laboratory environment. Additionally, competencies such as “I can create and maintain a safe working environment in the laboratory” (mean = 4.30) and “I can use appropriate teaching methods and techniques in laboratory studies” (mean = 4.18) reflect a solid foundational understanding of effective laboratory instruction.

On the other hand, some areas showed relatively lower mean scores, such as “I can use all the tools in the science lab” (mean = 3.32, “Somewhat Agree”). This indicates a notable gap in familiarity with specialized tools, which may stem from the limited availability of advanced laboratory equipment, as highlighted in previous tables. Similarly, while teachers agreed on their ability to develop and use simple tools for laboratory work (mean = 4.12), this suggests a reliance on improvisation to compensate for resource gaps.

Another key result is that competencies related to integrating experimental results with theoretical knowledge (“I can combine experimental results with theoretical knowledge to achieve new results”, mean = 4.05) were positively rated. This finding highlights the ability of the teachers to correlate practical work with curriculum objectives as a critical competence for effective science education.

These findings underscore the importance of continuous professional development programs aligned with laboratory-based instruction. Improving gaps in specific competencies, such as advanced equipment usage and tool mastery, will enable teachers to use laboratory environments more effectively. This would not only enhance laboratory instruction but also help to bridge the gap between theoretical and practical learning, so that students could be provided with a complete understanding of scientific concepts. Also, linking these competencies with practical implementation strategies will make teaching more cohesive and effective to meet 21st-century educational standards.

Conclusion

This finding shows that availability of laboratory equipment and facilities is an intricate function related to the science teachers' knowledge competence and proficiency in skill. For example, some equipment and infrastructure have relatively strong improvements for the teachers' competence while some bear very weak or even negative correlations with the competence. Hence, there exists an implication from this aspect as well: it does not simply mean the existence guarantees proper utilization. Important apparatus such as the Alcohol Burner, Beaker, and Glass Tubing have highly positive correlations since they are considered fundamental pieces of equipment to be used for hands-on science instruction. Often used in experimental laboratory work, their availability ensures that teachers increase their confidence to carry out investigations in science. Facilities, such as Benches and Electricity, have excellent correlations that speak to their key role in fostering a well-designed and effective functioning laboratory setting supporting effective teaching and learning. Other pieces of equipment used include specialized, not-so-often equipment that comprises the Air Blower, Centrifuge, and the Digital Geiger-Muller Counter. Its correlation is also weak or sometimes negative, therefore a low effect on the teacher unless proper training and integration to the curriculum take place. This report also stresses safety and supporting equipment like Fire Extinguishers and First Aid Kits. They, while not affecting the competency of a laboratory, help provide a secure working environment which boosts confidence in practical teaching.

Common utility equipment within a laboratory includes Storage Rooms and Water Supply and play their role in the overall organization and function of a laboratory. Even if the connection between this factor and teacher competence is not strong, more direct demand exists for the access to the apparatuses concerned than to infrastructural facilities. Conclusion In essence, though access to laboratory equipment and facilities was one of the factors proven critical for the betterment of competency of science teachers, success thereof was highly conditioned on proper training, more often utilization, and direct relevance for any level of practice in the sciences. For schools to maximize the impact of laboratory resources, accessibility must go hand in hand with training. Teachers should have available all the important tools but at the same time have the capabilities of using the tools to help enhance science education.

Implication of the Study

Laboratory Resources

1. **Increase Funding for Laboratory Equipment –** To guarantee that every school has access to sufficient resources, set aside extra funds to buy necessary science lab equipment and supplies.
2. **Periodic Resource Assessment** – To find shortcomings and create focused actions, regularly assess laboratory resources.
3. **Resource-sharing Programs** – Encourage cooperation among schools so they can share resources and knowledge in the laboratory, particularly in areas that receive less funding.
4. **Community Partnerships** – Encourage nearby companies or groups to sponsor laboratory supplies or offer funding for science instruction.

Teaching Competence

1. **Professional Development** – Put in place training courses that emphasize practical laboratory instruction and creative approaches to make the most of the resources at your disposal.
2. **Mentoring Initiatives** – To promote knowledge exchange and skill development, pair less experience teachers with more seasoned scientific teachers.
3. **Recognition and Incentives** – Establish award programs to honor superior laboratory-based teaching techniques and inspire teachers to keep getting better.
4. **Integration of Technology -** Equip teaches the technology and expertise they need to update laboratory instruction and adjust to changing requirements.

Limitation of the Study

Despite yielding valuable findings, this study is subject to several limitations that should be considered when interpreting results:

1. **Geographical and Contextual Constraints –** The study was limited to Schools Division of Ilocos Norte, which would have limited how broadly the results can be applied in other areas. Different outcomes in laboratory resources and teaching skills may result from differences in administrative processes, socioeconomic situations, and resource distribution in various regions..
2. **Reliance on Self-Reported Data –** teachers' self-reports accounted for a sizeable amount of data on teaching competence. Because of social desirability or subjective opinions, individuals may overestimate or underestimate their skills and experiences, which would lead to response bias.
3. **Measurement Inconsistencies –** There are inherent difficulties in quantifying both laboratory resources and teaching competence. Inconsistencies in data gathered

could arise from variations in the operational definitions and measurement standards used by different schools. Even though the study tried top standardize these metrics, some differences unavoidably remained.

4. **External Variables** – The results concerning laboratory resources and teaching competence may have been impacted by additional variables that were not entirely controlled in the study, such as variations in funding, possibilities for professional growth, and local regulations The validity of the study's conclusions may be impacted by these outside factors.

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