READINESS OF SCIENCE LABORATORY FACILITIES OF THE PUBLIC JUNIOR HIGH SCHOOL IN LANAO DEL SUR, PHILIPPINES

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ABSTRACT

The Philippine K to 12 science curriculum is a learner-centered and inquiry-based discipline that requires learners to utilize learning materials and learning spaces needed for a meaningful understanding of the scientific concepts and for developing their scientific literacy. This is anchored to the constructivism theory that supports 'learning by doing.' A laboratory is an essential place for active learning and science teaching that would provide students with opportunities to think creatively and critically to solve real-world problems. This study assessed the current status of the science laboratory facilities in two public junior high schools in the province of Lanao del Sur. This is to assess the current condition and availability of laboratory facilities and to identify the challenges faced by science teachers. This study employed descriptive case study method, in which the participants were from two selected schools in Lanao del Sur. A researcher-made checklist of laboratory facilities and semi-structured interviews were used to gather the data. Frequency was used as a statistical tool for quantifying the number of available laboratory facilities and equipment. Based on the findings, both schools have inadequate laboratory facilities that hinder the performance of the activities in the science module designed by the Department of Education. 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, 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.

Keywords: *constructivism, K to 12 Science, laboratory, Lanao*

INTRODUCTION

Student involvement and participation in the learning process are crucial for meaningful learning, especially in science education. This is extensively argued in diverse literature and research findings. Science education programs in the country are influenced by the principles of "learning by doing." As stipulated in K to 12 Science Curriculum Guide 2016, science as a practical discipline that is an inquiry approach, requires hands-on, minds-on, and hearts-on activities that feature the importance of active learning. Hence, it is deemed necessary for the learners to be well-equipped and well-guided not only with the facilitating science teachers but also with enough and appropriate facilities and equipment. Many public schools in the country are challenged by the lack of science laboratory facilities and equipment, including learning materials. With this, some science teachers may resort to skipping some laboratory activities if improvising materials is not possible that may hinder the realization of some competencies needed by the learners. Education plays an indispensable role in a rapidly evolving economic development. Similarly, science is relevant for building the economic and national development of the country. For the country to compete in the globalization of the industrial market, it needs human resources who are scientifically literate and skilled. To address these challenges, science, technology, and innovation must be prioritized in the country, effective and efficient science education is its critical component. Hence, science laboratories in schools are vital to developing the scientific literacy of the learners. The laboratory is where the individual or group students learn through observation, practice, and hands-on experiments with materials and phenomena, which provides them opportunities to relate and reinforce the theoretical concepts taught in class. As defined by de Borja & Marasigan (2018), laboratory is the heart of science in which individuals could put theory into practice.

The K to 12 Basic Education Program of the Philippines is one of the most significant educational reforms in the country. It aims to expand and improve the delivery of basic education in the country by providing and preparing Filipino learners with 21st-century skills and competence (DepEd, 2019). Aligned with the goals and features of K to 12 Curriculum, the science curriculum is a learner-centered and inquiry-based discipline that provides learners with competencies necessary in the society and the work field. It requires learners to engage directly with materials needed for understanding the scientific concepts and for developing their scientific skills. This is supported by the Theory of Constructivism that emphasizes active learning where teachers encourage students to have experiences and conduct experiments that permit them to discover, transform information and learn on their own instead of lecturing and controlling classroom activities (Bada, 2015). This shows the importance of doing laboratory activities toward the learning process. Thus, science facilities and equipment are necessary for public schools or any schools in the country to realize the goals of the said curriculum.

Further, it is impossible to imagine science without engaging in laboratory activities. Laboratory activities are one of the distinct features in all sciences throughout the years that support the engagement of the learners in real-world phenomena. Aside from the laboratory, qualified and equipped science teachers who are capable of teaching science subjects are vital in science education. The quality of teaching and learning experience depends on the teacher's effectiveness in using laboratory facilities and the extent of the sufficiency of laboratory facilities in the school. Thus, this study may serve as baseline data and may inform about the readiness of the science laboratory and the challenges faced by science teachers in some remote areas of the country in implementing K to 12 science curriculum. It may be of immediate benefit to the Department of Education (DepEd) in the identification and formulation of policies and practices aimed at enhancing the delivery of the science curriculum.

OBJECTIVES OF THE STUDY

The Philippine government puts many efforts in improving the quality of education throughout the country as envisioned by the K to 12 curriculum and the Philippine Education for All 2015. Efforts to reform and improve science education in basic education led to science as an inquiry-based discipline that requires equipped science teachers and adequate laboratory facilities. Therefore, the main objective of this study was to assess the readiness of the science laboratory in the Public Junior High School in the province of Lanao del Sur. Specifically, it aimed to: 1) assess the current condition of the science laboratory facilities and equipment in the school in terms of demographic profile of science teacher-respondents, class sizes per grade level, and available laboratory apparatus and equipment in both schools; 2) identify the challenges faced by science teachers during laboratory activities; and 3) determine how science teachers differ in addressing those challenges based on their teaching experience.

METHODOLOGY

This study employed a case study research design to investigate and describe the current condition of the science laboratory facilities and the readiness of science teachers for laboratory activities. The subjects of this study comprised the science laboratory facilities and the science teachers of the two public junior high schools, coded as A and B, in the province of Lanao del Sur, the Academic Year 2019-2020. Lanao del Sur is one of the five provinces of the Bangsamoro Autonomous Region in Muslim Mindanao (BARMM) in the Southern Philippines, or commonly known as Mindanao.
The two schools were conveniently selected by the researchers due to accessibility and availability to take part in the study with the permission of their respective school principals. Science teachers found in the two schools, coded as T1, T2, T3, T4, and T5, were purposively used for the study because of their teaching discipline and availability. Schools were personally visited and permission of the school principals was sought before the conduct of the study. The researcher-made checklist of laboratory facilities and equipment was used to identify the available laboratory facilities and equipment found in the school. The science teacher's demographic profile and teaching loads, and the learner population were documented. Likewise, the permission and cooperation of the Science teachers were also asked for semi-structured interviews. Both quantitative and qualitative data were obtained to attain the objectives of this research. The frequency was used to present the available laboratory facilities and equipment in the two schools. Thematic analysis was used to analyze the semi-structured interview data

RESULTS AND DISCUSSION

1. Status of Science Laboratory Facilities

The following presents the findings and interpretation of the data gathered from the responses in the interview.

1.1 Demographic profile of teacher-respondents. Table 1 shows the profile of the teacher-respondents, two from school A and three from school B.

Table 1
Demographic Profile of Teacher respondents

Teacher	Gender	Teaching Experience	Teaching Loads
$T1_A$	Female	11 years	6
$T2_{A*}$	Female	1 year	4
$T3_B$	Female	30 years	6
$T4_{B*}$	Female	2 years	4
$T5_{B*}$	Female	1 year	3

**Volunteer [A]School A [B]School B*

As shown, all were female; this supports the report of Oleros (2017) that females dominate the teaching profession in the Philippines. Three out of five respondents were volunteer teachers who were licensed professional teachers and currently applying for a permanent teaching position in the respective schools. They were in their first and second years of teaching experience. According to the school principals, they allow volunteer teachers because of a lack of qualified science teachers who will teach science subjects, as both schools lack science major teachers.

Meanwhile, the two permanent teachers were in their 11th and 30th year of teaching experience. However, they were non-science majors, one is an accounting graduate, and the other is a general education graduate. Hence, their teaching assignments were incongruent with their educational background. This conforms to the claim of SEI-DOST & UP NISMED (2011) that, the lack of qualified science teachers in many schools leads to practice assigning teachers to teach science subjects despite their limited background. As shown also, two permanent teachers have six science teaching loads following DepEd memo 105 s. 2015 while the volunteer teachers were underload, having three to four teaching loads.

1.2 Class sizes of school A. Table 2 presents the total population of the learners in school A for the Academic Year 2019-2020. There was a total population of 355 learners that was dominated by Grade 7 learners, with a total population of 135. While a total of 120 Grade 8 learners, 50 Grade 9 learners, and 50 Grade 10 learners.

Table 2
Class size per Grade Level of School A

Grade 7	Grade 8	Grade 9	Grade 10
50	30	30	25
50	35	20	25
35	55	-	-
135	**120**	**50**	**50**
			Total: 355

As shown, there was a significant increase in the number of learners as Grade 7 level had the most number while Grade 9 and 10 levels had the least. Given this learner's population, there was no laboratory room in the said school, which prompted science teachers to conduct laboratory activities in the classroom. This conforms to Ambag's (2019) claim that aside from lack of classrooms, other public schools in the country do not have a science laboratory to facilitate science activities.

1.3 Class sizes of school B. Table 3 presents the total population of school B learners for the academic year 2019-2020.

As shown, there was a total of 347 learners: 91 learners in Grade 7; 93 learners in Grade 8; 84 learners in Grade 9; and 79 learners in Grade 10.

Table 3
Class size per Grade Level of School B

Grade 7	Grade 8	Grade 9	Grade 10
33	35	32	41
30	29	26	38
28	29	26	-
91	**93**	**84**	**79**
			Total: 347

The two schools had almost the same number of learners. Unlike school A, school B has a SHS, in which there was only one laboratory room. Accordingly, due to having only two tables and 25 seats, the laboratory room was rarely used for laboratory activities and served as a storage room for the laboratory apparatus and science equipment.

1.4 Laboratory apparatus and equipment. Table 4 shows the available laboratory apparatus and science equipment in the two schools.

As shown, the two schools differed in terms of the availability and a number of apparatus and equipment found in each school. Some available equipment in school A was not available in school B, and vice versa. Further, available apparatus and equipment in school B were more in number than those in school A. Yet both schools had limited apparatus and equipment, like most of those available in School A was one piece only. Unlike school B, school A had no available chemicals and biological science equipment such as the dissecting kit, dissecting pan, and the human torso. According to T3 of school B, most of the science equipment supplied by the DepEd in their school was for SHS. This shows that the distribution of equipment was uneven between the two schools despite being in the same Division. Further, upon reading the label and inventory, it was found out that most of the science equipment supplied to School B was for Science, Technology, Engineering and Mathematics (STEM), an academic track in SHS. Yet the said school does not offer STEM strand in their SHS. This indicates that there was incongruence or mismatch on the supplies of the equipment in the said school.

Table 4.
Available Laboratory Apparatus and Science Equipment

Equipment	A	B
(Physical Science)	**Frequency**	
Advance electromagnetism set	1	---
alcohol lamp	10	12
Archimedes principle set	1	--
Barometer	1	--
Basic Lens set	1	--
beaker	6	8
battery holder	3	--
bulb holder	3	--
Bunsen burner	1	--
Chemicals:		
Gentian violet	--	2
Bromothymol blue	--	2
Iodine solution	--	2
Cover glass (box)	1	2
DC Ammeter	1	--
DC Voltmeter	1	_
DC string vibrator	1	--
Diffraction grating*	--	2
Erlenmeyer flask	1	--
Electronics kit	1	--
Electric blower	1	--
Evaporating dish	10	--
Florence flask	1	--
Funnel	7	10
Galvanometer	1	--
Graduated cylinder small	6	10
Graduated cylinder large	3	10
Hand lens magnifier	1	--
Hydrometer	1	--
Knife switch	1	--
Laboratory goggles	--	16
Magnetic compass	1	--
Measuring cup	24	20
Meter stick	2	5
Microscope	3	20
Microscope slide (box)	1	2
Mirror set	1	--
Molecular geometry model	1	--
Mortar and pestle	1	--
Motor-generator	1	--
Multi-meter	2	--
NSTIC Cart-rail system*	--	16
NSTIC set of coils*	--	16
NSTIC Stand setup*	--	16
NSTIC Variable power supply*	--	6
Petri dish	6	8
pH scale	2	--
pH paper	2	5
Pipettes dropper	--	10
Refraction tank	1	--
Resistance board	1	--
Resonance set	1	--
Set of wire connectors	4	--
Sound signal generator kit	1	--
Stirring rod	5	10
Student optical bench	1	--
Test tube	4	12
Test tube holder	1	2
Test tube rack	1	1
Thermometer	5	10
Triple beam balance	1	12
Tripod	1	16
Tuning fork set	1	1
Wash bottle	--	36
Watch glass	5	4
Weighing scale	1	--
Wire gauze	1	16
(Biological Science)	**Frequency**	
Dissecting pan*	--	8
Dissecting kit*	--	8
Human torso	--	3

*SHS equipment

On the other hand, School A had no laboratory room for storage of its apparatus and equipment, but instead it was in the Principal's office, which is a room divided by a partition where the other side is the mini school library. This also manifests the shortage of classrooms in the said school. Equipment for physical science was available in School A, but very limited that could only use by one to three learners. According to T1 and T2, due to inadequate equipment, they either grouped the class into two to three groups or asked some learners to perform the laboratory activity in the classroom center table while other learners were observing. Because of this, only a few learners can participate in the activity as others remained as observers. Meanwhile, according to T4 of School B, not all 20 microscopes in their school were functional because some of them were defective, like having a broken mirror or a broken objective lens. As can be inferred, laboratory facilities in both schools were inadequate to engage all learners in hands-on science activities. Inadequate laboratory facilities hinder effective teaching and learning and may contribute to the poor performance of students (Ngozi & Halima 2015). Otherwise, adequate and relevant laboratory facilities and materials cultivate a positive attitude and attitude change to science concepts (Katchca and Wushishi, 2015).

2. Challenges faced by Science Teachers during Laboratory Activities

As asserted by Olajide et al. (2017), teaching science in basic education without laboratory resources masks and alienates the values of science to the students, which may prevent them from pursuing science courses in higher education. Thus, laboratory exercises are ways to appreciate the reality of science and to understand science logically. Many have argued that without effective practical experiences in the laboratory, science cannot be meaningful to students. Adebisi, as cited by Olajide et al. (2017), stressed that one of the most effective experiences to develop the scientific skills of the students is a practical laboratory.

Based on the interview with the science teachers of the two schools, the same problems were prevalent in the two schools, to wit:

- *lack of laboratory room*
- *inadequacy of laboratory facilities and science equipment*
- *defective laboratory equipment*
- *inadequacy of learning materials (textbook)*
- *time constraint*
- *lack of water supply*
- *lack of electricity*
- *lack of maintenance or laboratory assistant*
- *difficulty in teaching some concepts*
- *lack of teacher training in using science equipment*
- *lack of training in science teaching*

Based on the interview responses, it is empirical to say that teachers and learners were challenged with inadequate laboratory facilities, science equipment, and even learning materials. Lack of water supply in both schools was regarded as the most burdensome for teachers and learners as they have to bring their water, especially during laboratory activities, for washing and cleaning the used apparatus. Accordingly, teachers were not trained on how to use some of the unfamiliar science equipment, thus made them hesitant to use some of the available apparatus and equipment in their respective schools.

3. Addressing the Challenges during Laboratory Activities

According to T1 and T2 of School A, lack of a laboratory room prompted them to perform the activities in the classroom. With the help of some learners, they bring the laboratory equipment in the classroom which mostly is suitable for one setup. Collecting apparatus from the storage before setting the activities also consumed a lot of time. Also, instead of letting all the learners do the activities by themselves, T1 and T2 selected some learners to perform it in front. At the same time, others were observing and answering their activities. As a result, only a few students can participate in a hands-on activity.

Similarly, science teachers of School B had difficulties in performing laboratory activities. Although the school has a laboratory room, they preferred to perform the activities in the classroom due to limited chairs. They also bring the laboratory equipment in their classroom and divide the learners into three to five groups. Accordingly, they had to alternately use the laboratory equipment as it cannot sustain two classes in the same period. As emphasized by T5 of school B, some of the equipment like microscopes was not all functional due to defects. The science teachers of the two schools said that they skipped some of the prescribed activities in the science module when needed materials were not available, or if improvised materials were not applicable. Accordingly, they bought some materials for the activities, and sometimes they asked their students to bring materials if possible.

Romulo and Ocampo, as cited by Capilitan, Cabili & Sequete (2015), emphasized that among difficulties and challenges in the implementation of the science curriculum were 'limited or lack of materials and proper facilities in performing a particular science activity.' Moreover, it was a consensus to all science teachers that time constraint was another problem during activity as it was rare to finish one activity in one period. The same findings of Capilitan et al., (2015), that time problem floated in the implementation of K to 12 science curriculum results delay to finish the lesson. Aside from inadequate laboratory facilities, teachers of both schools also found it challenging that some of the learners have no learning materials.

Thus, the sharing of materials among learners was being practiced. The lack of water supply of the two schools was considered as the most challenging as water being the predicate of sanitation and also important for washing and cleaning those used apparatuses. Because of this, learners were asked to bring water by themselves. The problem of waterless schools in the country was raised in the Senate, as Senate Recto, cited by Casayuran & Aben (2017), told DepEd and Department of Health (DOH) to address the needs of thousands of waterless schools by installing water facilities and more toilets.

Another problem was the lack of electricity in School A. DepEd is fully aware of the lack of classrooms, learning materials, electricity located in off-grid areas, and lack of water sources in many public schools (Alcober, 2018). Nevertheless, School A is among schools that have been installed with solar panels for ICT class. Based on the interviews with the five teacher-respondents, they honestly admitted that they have difficulties in teaching science concepts. T1 and T3, who have been in service for decade/s had said that since the implementation of K to 12, they were challenged in shifting from the traditional method (lecture method which they are used to) to inquiry-based approach. The two being non-science major was constrained to teach science due to a lack of qualified science teachers in their respective schools.

Accordingly, when the topic was difficult, especially when materials for activities were not available, they did the lecture method instead. Meanwhile, T2, T4, and T5 were at the beginning of a teaching career as volunteer teachers. They also admitted that they had to study the lessons ahead, especially with those topics under subjects that were not in their specialization. Like T4, as a biology major, found it challenging to teach physics concepts. Because of having difficulty in teaching some concepts not related to one's major, teachers tended to teach the lesson based on their understanding. And this may compromise the learning of the students (Capilitan et al., 2015). T2, T4, and T5, being equipped with ICT, used downloaded video as an aid in their lecture teaching when materials needed for activities were not available. This is also similar to the findings of de Borja & Marasigan (2018) that the majority of the science teachers in their study 'download YouTube videos experiments or activities to show the concept or content being discussed.' Accordingly, it was more convenient for them to use video as it does not require too much time to set it. However, they were also bothered by those learners at the back for the visibility of the video as they were using a laptop. This indicates that unlike other public schools that have smart TVs in their classrooms, these schools do not have a smart TV in their classrooms. Although the schools have LCD projectors, the lack of electricity in the school hinders them from using it. It was also evident that these teachers know how to improvise materials. Accordingly, they buy materials, recycle materials, or ask the learners to bring one if possible for improvising materials needed for the activities. Another problem raised by the teacher-respondents was the lack of training both in using the available science equipment and lack of training in science teaching. Accordingly, they were unfamiliar with most of the equipment. They found it challenging to use them, like the NSTIC Cart-trail system, diffraction grating, and advance electromagnetism set. These common issues needed attention from DepEd and should be addressed promptly.

CONCLUSIONS

From the findings, the following conclusions are made:

1. Laboratory facilities in both schools are inadequate to engage all learners in hands-on science activities. Thus, learners are less involved in inquiry-based activities.
2. Science teachers in both schools are not equipped in facilitating laboratory activities.

3. The science teachers need training/seminars in handling laboratory facilities and in facilitating science laboratory activities

RECOMMENDATIONS

The following recommendations were drawn based on the conclusions:

1. To realize the goals of K to 12 science curriculum as a learner-centered and an inquiry-based and to ensure the provision of quality education throughout the country, it is recommended that the government, especially DepEd and all the stakeholders in public junior high schools may consider the adequate provision of laboratory facilities, including laboratory rooms in every school.
2. Science teachers may be trained on how to use science equipment to ensure that they are equipped in using/operating them.
3. Science teachers may be encouraged and be supported to attend regular workshops and seminars on improvisation of materials and science activities and, of course, pedagogical content knowledge in science education.
4. Addressing the identified challenges is recommended to achieve quality education for all.

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