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Lived Experiences of Science Major Students in the Absence of Laboratory Activities

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ABSTRACT

The importance of laboratory activities in science education cannot be overstated. Scientific laboratory activities and experiments have helped students absorb science lessons more easily in recent years. Science cannot be more valuable to students if they do not get laboratory experience in school. As a result, the goal of this research is to learn about science major students' lived experiences in learning science with the lack of laboratory activities while also identifying the obstacles they face. In an in-depth semi-structured online interview, ten science major students were asked to describe their learning experiences in science with and without laboratory activities. The students' shared experiences described learning situations that did not involve laboratory activities as "finding light in the dark". To put it another way, the students find the learning materials difficult to understand because of the unfamiliar terms they have encountered. Moreover, the lack of learning resources and home-based experimentation equipment and materials to perform the required laboratory activities made it even more difficult for them to gain new knowledge and formulate specific scientific explanations.

INTRODUCTION

Background of the Study

In the past years, science laboratory activities and experiments helped students understand their Science lessons easily. Laboratory activities allow the students to interact with the materials, observe and understand the nature of learning science. These activities help the students be involved in the process of constructing their meaningful learning experience towards the subject. Productive learning is possible in a laboratory where the students can explore the equipment and materials to build on their knowledge and ideas related to the sciences. The laboratory is the heart of science in which individuals can put theory into practice (de Borja & Marasigan, 2018). This study aims to determine the learning experiences of Science major students in the absence of laboratory activities. Their difficulties and suggested coping strategies are also illustrated, demonstrating students' eagerness and optimism to learn amid the challenges and struggles they encounter. The researcher finds this study timely and relevant because it is what the learners are experiencing today—trying to identify issues that can be addressed to help learners deal with the challenges and hardships they face by sharing their coping strategies and ways to establish self-efficacy that will allow them to overcome the academic battles they are experiencing.

Statement of the Problem

The study aimed to determine the learning experiences of Science Major Students in the absence of laboratory activities. This research seeks to answer the following problems:

1. What are the learning experiences of Science major students in learning science in spite the absence of

laboratory activities?

2. What are the difficulties experienced by Science major students in learning science in spite of the absence of laboratory activities?

3. What are the coping strategies of the Science major students in learning science amidst the difficulties brought by this new mode of learning?

LITERATURE REVIEW

Laboratory some long been thought to be integral part of science education (Kwok, 2015). But when the COVID-19 pandemic has wreaked havoc, education systems around the world are being affected in approximately 1.6 billion students in over 200 nations (Pokhrel, 2021). Though science education is connected chiefly to experimentation and laboratory activities. Traditional educational techniques have been considerably disrupted by social distancing and limited movement policies. Reopening schools when restrictions have been lifted is another problem, as many new standard operating procedures have been implemented (Chhetri, 2021). This given educational administrators the chance to pioneer the road for digital learning (Dhawan, 2020). On the other hand, due to reduced teaching hours for learners and a lack of interaction with teachers when confronting challenges in learning/understanding, students' academic performance is likely to decrease in classes held for both year-end examination and internal examination (Sintema, 2020). That make United Nations (2020) conclude that depending on how long the lockdown lasts, the entire exam evaluation could be postponed or cancelled. Thus, the latest literature states that the importance of investigation in increasing students has participation in the learning process..

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Similar findings are found in the study of American Chemical Society (2017), Research has shown that students who engage in well-designed laboratory experiences develop problem-solving and critical-thinking skills, as well as gain exposure to reactions, materials, and equipment in a lab setting. Doosti (2015) described that laboratory work has positive influence on science education and it enhances the cognitive skills of science students but shortage of equipment, low quality of laboratory material and overcrowded classes are big hurdles in the way of effective implementation of laboratory work.

On the other hand, remote laboratories have become more popular, with computers and other technology playing an increasingly important role in the learning process. Learners manipulate actual equipment and the data that comes from their manipulation in remote laboratories (Bernhard, 2018).

As a result, laboratory interactions are an essential part of students' development of scientific skill and understanding (Latour, 2013). This experience helps them understand the subject matter and then later gain the ability to face similar cases and understands the same problem. Laboratory experiences that are well-planned have a lot of potential for attracting young people to science classes (NCERT, 2013). Creating learning environment that encourages meaningful laboratory experiences is a good way to arouse and sustain student's interest in science. Students with occupied laboratory work that promotes fun experience and prospective science teachers will lead student to participate and collaborative with their peers and educators. In this way, science laboratory activities help the students to become more productive in school and cultivate lifelong skills. And, if the pre-service teachers do not get a chance to create activities, experiments, working models, and projects, they will surely encounter difficulties in guiding their future students in their laboratory experiences. In order to have a productive chemistry and biology instruction, laboratory equipment and their functions should be emphasized in chemistry and biology teacher education programs more deeply. Lack of experiences in performing science laboratories may contribute in difficulties the teachers may experience in their teaching career. It is because teachers have a great responsibility to reach this goal.

Most professionals argued that without practical use of laboratories, students could not be appreciate science (Olajide, 2017). Olajide also added that one of the effective ways to experience and develop scientific skills is through the laboratory. In general, students need to conclude that understanding what they do, why they do, and how they will construct a feasible explanation for their experiences, specifically in the laboratories (Unal & Ozdemir 2013).

But at some point, Faulconer and Gruss (2018) state factors that insist that laboratory is no longer needed in learning. This includes:

Practical skill development

The importance of conventional laboratory experiences in developing practical skills required to perform more advanced research is a popular argument in favor of them. However, there is no evidence in the literature that students who completed an introductory lab using non-traditional methods perform worse in more advanced labs than students who completed an introductory lab using traditional methods. That said, some procedural skills need sensory input for which a simulation would not be adequate (Brinson, 2015).

Cost

The cost of different modalities to students varies by institution. Students must pay lab fees for conventional laboratories and buy a lab manual in some instances, while other institutions do not charge lab fees. The cost of lab kits varies greatly depending on how often they are used in the course. Online simulations are frequently less expensive than lab kits.

Growth potential

The ability to expand is a direct advantage of non-traditional laboratories. Traditional laboratories have limited space due to infrastructure, and bottlenecks can occur. Cal-Tech uses non-traditional laboratories to solve this problem (Rivera, 2014). E-Science labs are a non-traditional lab alternative in which kits are delivered directly to students worldwide, and the experiments are carried out at home with the help of video guides, animations, and a lab manual (eScience Labs, 2014). On the other hand, Late Nite Labs is a company operated by MacMillan that provides virtual lab environments with over 100 experiment options (Late Nite Labs, 2014).

Accessibility

The increased usability of non-traditional laboratories is a direct advantage. Learners can interact with the material independently thanks to online simulations, remote access, and lab kits. This is especially beneficial for non-traditional students who have a full-time job, a family, or are deployed in the military. These non-traditional laboratory formats often provide access to resources that are not normally accessible in a traditional hands-on lab. In specific non-traditional lab environments, learners have more time to deal with the content than they would in a conventional 3-hour weekly lab session. According to surveys, students consider this as an advantage (Turner & Parisi, 2008).

Compared to online or conventional laboratories, one disadvantage of lab kits is the inability to repeat experiments, mainly if an error occurs. For microscale experiments, lab kits typically do not include extra reagents. A spill or a mistake in the procedure may.

Student-instructor contact time

Another factor to remember is that non-traditional laboratories are primarily asynchronous. This indicates

that the teacher or teaching assistant is not in clear view of the student. Depending on the pedagogical choices made in the course design, this may also restrict peer cooperation. Asynchronous laboratory interactions' unsupervised nature can also make it challenging to ask timely questions. This can reduce safety awareness and increase risks associated with laboratory work in non-traditional laboratories that use lab kits.

Safety considerations

Another thing to think about is the kinds of interactions that each modality can facilitate. Hands-on laboratories (both typical and lab kits) reinforce content as well as procedural skills. To control risks, the course should include a safety feature. The challenge is to create activities that are appropriate for transportation/delivery and unsupervised testing and engaging and free of apparent effects that would distract from motivation to complete an experiment. Lab kits are microscale and use low-risk chemicals due to these factors (Gould, 2014).

On the other hand, while online simulations effectively reinforce the material, they often overlook safety and do not accurately represent actual procedural skills. Although remote labs are likely to be better at simulating procedural skills, protection may not be addressed automatically.

In summary, learning science with or without a laboratory affects students, especially in the learning experience. Either both circumstances, there are many possible reasons behind how it affects the students' learning experience. Therefore, the researchers are looking forward to hear the shared experiences of the participants.

METHODOLOGY

This chapter describes the research method used in this study. It includes the research design, participants of the study, the locale of the study, research instruments, data gathering procedure, and data analysis.

Research Design

This study employs a phenomenological design as a qualitative method. In phenomenological design, the fundamental questions about the perceptions or experiences of this phenomenon and the circumstances in which these experiences occur have been asked (Creswell, 2013). The participants share their perceptions and experiences of the phenomenon. The lived experiences of Second Year and Third Year Bachelor of Secondary Education Science Major Students in learning science in the absence of a laboratory are investigated in this study. Each participant in this research must have concentrate on his or her reality and report of his or her experiences.

Research Participants

The participants of the study were the selected ten (10) students from the second year and third year Bachelor of Secondary Education Science Majors who were currently enrolled for the Academic year 2020-2021, Second Semester in the time of pandemic.

Research Sampling

In this study, the researchers used purposive and convenient sampling to identify the participants. Convenient sampling is a nonprobability sampling technique, where the participants are being drawn from that part of population that is closed to hand. According to Polit and Beck (2006), in a study convenience sampling includes respondents who are readily available. In other words, it is a method of collecting samples from a location or internet service that is conveniently accessible. The main goal of convenient sampling is to get the participants wherever we can find them and typically wherever the participants are convenient and are willing to answer the research questions.

Instruments of the study

The primary data collection method was an online in-depth interview using semi structured with open-ended questions developed by the researchers. In this research, the interview technique was used within the context of phenomenological trends to obtain students' opinions in the absence of laboratories while studying science. The primary data gathering technique is an interview in a phenomenological design. The interview methodology allows researchers to ask questions of engagement, flexibility, and additional conversation to expose the experiences and meanings of the occurrences. Individual semi-structured interviews with the participants were conducted using this interview approach.

RESULTS AND DISCUSSION

This chapter presents the phenomenological qualitative analysis of the participants' responses on the following research questions: (1) What are the learning experiences of Science major students in learning science in spite the absence of laboratory activities? (2) What are the difficulties experienced by Science major students in learning science in spite of the absence of laboratory activities? (3) What are the coping strategies of the Science major students in learning science amidst the difficulties brought by this new mode of learning?

This chapter also provides a discussion of the themes from the analysis of the participants' narratives. This phenomenological study aims to explore the observable and actual manifestations of the learning experiences of science major students in the absence of laboratory activities.

The main goal of phenomenological research is to seek reality from individuals' narratives of their lived experiences and feelings, and to produce in-depth descriptions of the phenomenon (Yuksel *et al.*, 2015).

Establishing self-efficacy

Establishing self-efficacy is one of the coping mechanisms that push the students to continue learning despite the difficulties in understanding their lessons in this new normal. These central themes were formulated based on the responses of the participants. When inquiry

learning is used, positive attitudes and enhanced student participation have been observed (Elliott & Page, 2010). The students are enhancing their Time Management Skills, Developing Strategies, and Showing Optimism in Learning on how to pursue their studies in response to their course requirements.

The participants identified positive impact of establishing self-efficacy that made them motivated and full of interest towards learning. This helped them continue their education despite the difficulties they have experience in understanding the materials given by their course instructors.

As discussed by Learner 6 that during the time of pandemic when many of what was performed in science education was halted, the successful experience which he had gone through was when he kept himself learning and understanding science topics despite lacking demonstration in physical laboratories. He continuously seeks for understanding about the given lectures and somehow manages to acquire learning's.

Such findings are in connection to the study with high optimism, it is expected that students' academic performance will be maintained and they are able to make adjustments from the new mode of learning. According to Ickeson, *et al.* (2020), while positive expectations often increase student academic performance, they may also contribute to academic failure if linked to unrealistic expectations of achievement. High awareness can control the adverse effects of increased optimism, such as unrealistic expectations and overconfidence.

Resourcefulness in Finding Resources

To have a better understanding of the lesson being given by their instructors, the participants are being resourceful to find and use available resources to solve the difficulties they have experienced and have a deeper understanding of the topic. In connection with this, it is more important for the students to possess this trait in the pursuit of success in their studies. As mentioned by learner 3, the teacher sends them a YouTube link to understand the laboratory activity and we no longer need to perform. What they need to do is to understand the theory behind it. He used the learning materials to answer the activities, and used them as a basis to find other resources to understand the lesson better.

This finding is similar to the study of Franklin (2018), resourcefulness has been defined as community's capacity to engage with their local resource base as a means to address the unequal distribution of resources. Moreover, being resourceful would greatly benefit the students learning.

Adaptation and Adjustment to New Mode of Learning

Adaptation is considered one of the essential capacities of human behavior, and it is also a factor in human motivation and satisfying human needs (Alzboon, 2013). The major theme of adaptation and adjustment to learning resources emanating from lack of experience described

the journey of the college science students. In this case, the students had been confronted with experiences in learning science in the absence of laboratory activities. As Learner 1 said, if he will based on his adaptation in this new normal? It is still hard to adjust because during face-to-face, in every laboratory though it is hard still, we can come up with good results, unlike this new normal, it made the subject even harder.

The majority of participants are likely to change in their use of the resources provided by their instructors, which include informational materials that serve as learners' guide in responding to activities and comprehending the lesson's concept. Some participants, on the contrary, are still looking for extra materials to assist them comprehend the lesson without having to perform it.

Defining difficult concepts

Difficult concepts and learning's govern our lives, and the harder we look at them, the more they seem to be complicated and extend. Complex ideas are difficult to analyze from a psychological standpoint. They can be developed from basis ideas and categorization. In connection with this, the participants have mentioned how they overcome difficult concepts in learning science in the absence of laboratory activities. For that reason, Learner 7 narrates that the difficulties that she experienced as she learn science without doing laboratories are: she have to understand a manual given to them on her own and she have to be the one to look for the different resources for her to understand a topic a lot more. By this reason, learners can easily move forward if they can define difficult concepts using the materials they can find in the internet that is related to what their instructor given.

Stumbling block in learning in new setting

The main problems encountered by the participants are lack of home-based experiment pieces of equipment and materials and the absence of laboratory activities.. According to the study is David Kolb's Experiential Learning Theory, the knowledge is formed through the transformation of experiences, as well as the result of the combination of comprehending and transforming experiences (Kolb, 1984). The idea stresses how learning is influenced by experiences such as cognition, environment, and emotions (Cherry, 2020). They said that any lacking learning materials might result in ineffective learning outcomes and poor academic performance. Difficulties in learning in a new setting are another central theme that challenges students towards a positive learning outcome. This answer is General because all of the participants stated the same difficulties as they learn in the new setting.

The participants stressed the importance of laboratory activities in learning science concepts. Many who are experiential and visual Learners, in particular, benefit from being able to view and see things visually. There is a strong need for laboratory exercises to assist students in learning and comprehending concepts.

Household Disruptions

One of the difficulties experience by the participants in learning science in the absence of laboratory activities is household disruptions. Participants who experience household disruptions are having hard time in focusing in their studies. In line with this, household disruption is a big setback that causes the participants to change their plans or causes learning process to be interrupted. According to Kamuti (2015), child developmental outcomes such as cognitive ability, school readiness, academic achievement, and emotional adjustment are influenced by the home environment. Furthermore, this subtheme explains the participants challenged to utilize their household spaces to achieve a conducive learning environment. Learner 5 stated that, at first it seems quite weird that her learning's happened inside her bedroom. It has been a challenge considering that the courses were planned face-to-face situations and are now in transition to remote education. On the other hand, due to the situation of inequalities some do not have the access to internet and those students who opted the modular learning were distracted by many reasons.

Participants are always looking for a suitable environment as they continue learning. They need to be away from noise and destruction to focus. The cooperation of other people around them especially their family members has a significant impact on their ability to learn the concepts of their lesson.

Unclear Instructions About Performance Task

Performing activities is very difficult when you received unclear instructions about what you supposed to do. In connection with this, unclear instructions about performance task can affect the performance of the learners as well as their learning's. As narrated by Learner 5, there are instances where the instructions are not clear. They always ask questions to be fixed. They communicate with their instructor through text or messenger chat.

The findings in this study is supported by Schendel (2017), primary, teachers are sources of problems when they fail to identify applicable topics relative to student's degree of understanding and explain the correct criteria due to poor knowledge in preparing rubrics. On the contrary, the learners can learn best when the teachers can further discuss the performance task and from that instructions they can create a scientific basis on how to perform their task on their own.

Unresponsive Teacher to Student Queries

One of the difficulties experienced by the participants is the unresponsive teacher to student queries. Students are having hard time to understand their lesson in science due to the absence of laboratory activities and lack of home-based experiment materials. In line with this, students are raising questions that made them confuse. Some of their instructors do not answer them that made them struggle more in doing their tasks and assignments. As narrated by Learner 2, it is tricky because some of their instructors

are not approachable, every time they reach them out, some of their messages remain delivered, and if ever they have seen it, it takes few days before they open. They want to finish the task on time; sometimes it's too late because their instructors respond too late.

With this reason, students have to take action and find another way on how to understand their lesson without waiting to what their instructor may respond to their quires.

Lack of Home-based Experiment

Equipment and Absence of Laboratory Activities

From the shared experienced of the participants, lack of home-based experiment equipment and absence of laboratory activities is one of the stumbling block in learning science in the absence of laboratory activities. Moreover, laboratory activities are essential for the science learners to explore ideas and put scientific theories into action. As mentioned Doosti (2015), described that laboratory work positively influences science education and enhances science students' cognitive skills. Still, shortage of equipment, low quality of laboratory material, and overcrowded classes are significant hurdles in implementing laboratory work. Learner 3 clearly states that the lack of materials will result in the incorrect performance of the lab procedure. Then it will result in a difficulty that he experienced in answering and lab report. Also he doesn't know what to put in the answer, and they will lack of knowledge because they didn't perform the lab activity due to a lack of materials. They also experience difficulty in finding substitute materials once the lab activity is misused.

The participant's poor performance indicates that they have limited resources and have difficulty grasping unfamiliar and complex topics. According to the participant's responses, one factor impeding their learning is a shortage of instructional materials.

Surviving the Challenges

In spite of the difficulties experience by the science major students in learning science in the absence of laboratory activities, the participants have share different strategies how to survive their challenges. Surviving the challenges is intended to raise awareness about various concerns as well as to explore areas in learning where they might want to make changes. In connection with these, the participants should continuously be looking for methods to improve their learning strategies in learning science in the absence of laboratory activities.

Time Management Skills

Good time management can help you advance in your studies. Organizing your day allows you to finish assignments and tasks given on schedule, stay focus during difficulties, and be creative and proactive in your responsibilities. Indeed, having a good time management skills can help you achieve important goals and advance in your studies. Being an effective time manager requires

you to prioritize each of your obligations. You must decide to start with quick, uncomplicated tasks and work your way up to longer, more intricate tasks.

Correspondingly Learner 1 said, he always take time to read and watch videos in advance about the next laboratory activity. Also he read and watches 1-2 hours every morning then 2-3 hours at night.

In connection with this, Each and every student's should have time management ability which includes setting goals and priorities, using time management mechanism and being organized in using time (Nasrullah, 2015). Along with, it is very important that you know your priority on how you handle your challenges and established strategy to overcome it.

Optimism

The core ideas optimism is related to individual confidence in facing challenges in learning science in the absence of laboratory activities. Optimistic students, on the other hand, actively seek out opportunities to increase their well-being and reduce stress in their studies. Based on the participant's responses, optimism is about taking a step back and deciding to focus on the positive aspects of the situation. As stated by Learner 2, she says that they must be creative and resourceful in our learning because in this time of pandemic the one who can help themselves is them. She added, meaningful learning may come from reading alone not what is taught by our teachers.

Similar finding is seen to the research conducted by Siddiqi *et al.* (2016) states that the higher the individual optimism, the higher the individual's belief. The more the students became optimistic in learning, they will have a positive outlook in spite the difficulties they experienced.

Utilization of Household Space

Creating a space at home that is suitable for learning is challenging but when you learn on how you can utilize them, it is useful for you to continue learning. When utilizing household space, you need to consider the disruptions and you have to be flexible in doing your task especially in doing a home-based experiment. In addition, it is the major method for determining success and performance efficiency. This is particularly true when it comes to tools and equipment. This is attested by learner 6, she will make sure that the house is free from unnecessary noises by turning off the television sets and other gadgets that produces noise. If there were any people in the house, she will ask them to minimize the volume of their voices when talking as she will be taking her classes.

On the other hand, learning can happen in every space you like to study. Despite of the difficulties you can experience, you have to become innovative by using the household space you can use.

Collaboration with Classmates

Mochvan (2018) stated that building a positive relationship with subject teachers and classmates is essential for

successful learning. It is one of the prominent trends that emerged from the people who participated in this study. Most of their classmates have shown a positive attitude and collaboration with classmates to sustain a positive learning relationship. On the contrary, some of the participants also experience unclear instructions about the performance task, less interaction from teachers, and unresponsive teacher to student queries are some of the problems they experience. With technological advancements, the students have many more avenues to collaborate outside of the classroom outside of the schooldays. It also gives student's opportunities to collaborate in virtual space. As mentioned by Learner 7, she communicate/collaborate with her classmates through Messenger. They send message and ask each other if they have topics that are difficult for them to understand.

Maintaining the collaboration with you classmates is so beneficial in a way that you can ask clarification on the part you have not understood. Through collaboration with your classmates, you can gather information that can help you to finish your task on time.

Assistance of Instructor

Students are often connected to instructors in the classroom. Since the pandemic has begun, physical contacts are being limit or remove. In learning science, assistance from the instructor is very important for you to perform the laboratory activities correctly. In this study, one of the core ideas that emerged is the assistance of the instructor. Furthermore, participants mentioned that having assistance with your instructor is a great help for them to perform a home-based experiments with the given consideration. As shared by Learner 2, luckily, some teachers can understand and adjust for them. They innovate by simplifying it to more accessible activities even if we are at home. Then they only chose activities that are suitable for the learners' capacity.

Such finding is mentioned DeMonbrun *et al.* (2017), states that explanation strategies provide students with clarifications and reasons for using active learning. Moreover, with clear explanations from their instructor can help them to understand their lessons easily.

CONCLUSIONS

Based on the results and findings of this research, the difficulties experienced by the science major students in learning science in the absence of laboratory activities is part of the challenges that they are facing in dealing with this new learning modality. The information discerned from this study may motivate the students to continue in their studies and provide them with strategies for creating new ideas. The results can be used by the students to establish self-efficacy towards learning science in spite of the absence of laboratory activities and the designed personal learning strategies that can help them to learn productively and effectively. It can be noted that self-efficacy promotes support and guidance to students and

help them set awareness, inspiration, and motivation about their experiences how they can cope with the challenges they encountered in learning science.

This research can be a source of information that will pursue science as their specialization dissemination in the learning of new science major students to inspire them to promote and include laboratories and home-based laboratory as the process of formulating scientific explanation in learning science. The lived experiences of the science major students may assist the instructors in drawing evidence and support to address the difficulties the students' experience and help them overcome the challenges they have identified.

For future researchers, this research may assist them in evaluating other issues related to learning science in the absence of a laboratory, as well as issues outside the scope of the phenomenon being studied. In addition, future researcher can make use of the coping mechanisms mentioned by the participants who were conducting home-based experiments and developed the positive attitudes that the respondents have established, to continue learning science despite the identified challenges. Additional studies are necessary for the phenomenological qualitative data gathering and quantitative technique or mixed methods. The findings of this research may also be replicated in a broad scope to determine more challenges and difficulties experience by the new science students in learning science in the absence of laboratory activities.

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