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Kolb's Experiential Learning Theory Application in Home-based Laboratory Activities of Science Major Students in Microbiology Subject

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Abstract: Kolb's Experiential Learning Theory Application in Home-based Laboratory Activities of Science Major Students in Microbiology. Objectives: This paper describes the experiences of science major students in doing their home-based laboratory activities in microbiology during the onslaught of the COVID-19 pandemic. It is framed on Kolb's experiential learning theory. **Methods:** Using criterion sampling, nine BSEd Science major participants were interviewed face-to-face to describe their experiences using phenomenological hermeneutics. Kolb's theoretical constructs were used to thematically analyze the participants' responses. **Findings:** It revealed that students prefer doing laboratory experiments at school than at home due to the availability of laboratory materials. Students experience difficulty in doing home-based laboratory activities due to the difficulty of providing alternative laboratory materials to complete the laboratory tasks at home. Nevertheless, students gain self-development skills such as communication skills and resourcefulness. **Conclusion:** Science major students in microbiology have developed skills in adapting to the changes brought by the COVID-19 pandemic, thereby, they developed flexibility and resourcefulness in accomplishing their home-based laboratory activities.

Keywords: experiential learning theory, home-based laboratory activities, microbiology, phenomenology, science majors.

Abstrak: Penerapan Teori Kolb Experiential Learning dalam Aktivitas Laboratorium Berbasis Rumah bagi Mahasiswa Jurusan Sains Mikrobiologi. ***Tujuan:*** *Makalah ini memaparkan pengalaman mahasiswa jurusan sains dalam melakukan kegiatan laboratorium mikrobiologi di rumah selama pandemi COVID-19. Pembelajaran menerapkan teori Kolb experiential learning.* ***Metode:*** *Dengan menggunakan sampel kriteria, sembilan peserta utama BSEd Science diwawancarai secara tatap muka untuk menggambarkan pengalaman mereka menggunakan hermeneutika fenomenologis. Konstruksi teoretis Kolb digunakan untuk menganalisis respons peserta secara tematis.* ***Temuan:*** *Terungkap bahwa siswa lebih suka melakukan percobaan laboratorium di sekolah daripada di rumah karena ketersediaan bahan laboratorium. Siswa mengalami kesulitan dalam melakukan kegiatan laboratorium di rumah karena sulitnya menyediakan bahan laboratorium alternatif untuk menyelesaikan tugas laboratorium di rumah. Namun demikian, siswa memperoleh keterampilan pengembangan diri seperti keterampilan komunikasi dan kecerdikan siswa.* ***Kesimpulan:*** *Mahasiswa jurusan sains mikrobiologi telah mengembangkan keterampilan dalam beradaptasi dengan perubahan yang akibat pandemi COVID-19, sehingga mereka mengembangkan fleksibilitas dan kecerdikan siswa dalam menyelesaikan kegiatan laboratorium berbasis rumah mereka.*

Kata kunci: *experiential learning theory, aktivitas laboratorium berbasis rumah, microbiology, fenomenologi, jurusan sains.*

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INTRODUCTION

The COVID-19 virus, caused by the SARS-CoV-2 virus, first appeared in China in December 2019 and quickly spread over the world forcing the Philippines to close all its physical educational institutions. Thereafter, to ensure academic continuity after months of lockdowns, schools reopened and migrate to cyberspace teaching-learning modalities and home-based learning (Jamoral, 2023).

Home-based learning is one of the feasible alternatives to continue learning. Students benefit from home laboratory activities in a variety of ways. The most crucial benefit is that it is convenient for students. Home laboratory activities, like other aspects of distance education, allow students to avoid time-consuming excursions, study when and where they choose so that they may balance work, family, and social obligations, work at their own pace, and repeat observations as needed. Based on learners from the surveys of online laboratory courses, the significance of efficient management of time in the course that has links to the laboratory activities and assessments (Reeves & Kimbrough, 2004) for the students to monitor their time in finishing and finalizing their hands-on laboratory at home has been highlighted. Aside from this, eScience laboratories, where experiments are carried out at home through the help of virtual lectures, animations, and a science laboratory manual, are another alternative to a non-traditional lab (eScience Labs, 2014). Hands-on laboratory omitted to employ kits for the laboratory; instead, the thing is that they used common home objects in a manner like with "kitchen chemistry" method (Casanova, et al., 2006; Lyall & Patti, 2010). The kitchen chemistry approach can be scaled to the enrollment which is excessively high, and at almost no expense to the students and institution.

A typical scientific laboratory must be included in the science program (Singer et al., 2006), as the science laboratory has an important and distinct role, and science educators have stated that engaging students in laboratory activities can give considerable learning benefits. Virtual lab scientific research (Pyatt & Sims et al., 2012), computer simulations, video-based experiments, and remote-controlled inquiry (Waldrop, 2013; Kennepohl, 2009), have stayed a concern of online science course of study in education, and there is increasing evidence that learners acquire at least as much in these formats as they do in traditional hands-on, in-person science classes (Brinson, 2015). Studies of online laboratories utilized primarily as supplemental education have found that they can assist students to improve their cognition and readiness for the hands-on lab, as well as boost their abstract knowledge (Dalgarno et al., 2009). Increases in student performance have been linked to deep engagement (Jaggars, Edgecombe, & Stacey, 2013). This deep engagement strengthens the lab course's goal which is frequently to teach self-development skills and safety precautions, as well as transferable abilities including collaboration, administration of time, communication, and resolving conflicts (Boyer, 2003; Rugarcia, Felder, Woods, & Stice, 2000) and encouraging the acquisition of information (Casas & del Hoyo, 2009). Moreover, the learner's knowledge of science was accumulated as an outcome of the hands-on experiments, direct observation, and immersion into their world (Sobel, 2004). According to Cronin-James (2000), hands-on science has a bigger effect on knowledge than on attitude in young students, and this leads to students not only gaining skills in science through outside learning, but also transferring their knowledge and skills to other topics. Students become active in their learning in many science laboratories by seeing, observing, and doing, and this type of application can provide not only better but also long-term learning (Temel, Oral, & Avanoglu, 2000).

However, due to the pandemic, even laboratory tasks that were formerly performed in a school laboratory were turned into online laboratory activities. One of the most challenging Science subjects with the necessary laboratories to be done is Microbiology due to its nature of studying microscopic organisms (cellular and subcellular), primarily those that are smaller than the human eye's resolution power (Rojas-Trevio, 2011). Because of the alleged necessity to give a comparable laboratory experience that is likely the same as in the school laboratory setting, creating an adaptive method of online format to teach the learner in science courses such as hands-on experiments at home has been harder (Bulusan, Codamon-Dugyon, & Bolintao, 2022). Furthermore, recent studies have found that there are no differences in specific learning outcomes when comparing learning from online laboratories to identical simulations and hands-on knowledge in the laboratory (Tho, Yeung, Wei, Chan, & So, 2017; Ma & Nickersen, 2006).

Given the many benefits of home-based learning and the challenges of doing home-based laboratory activities, this study aims to determine the experiences of Science major students in conducting their home-based laboratory activities using Kolb's Experiential Learning Theory (ELT). ELT is a holistic approach to student learning which includes action/reflection and experience/ abstraction (Kolb & Kolb, 2011). The cycle has no beginning or endpoint, guaranteeing the students can begin at any point. Kolb's ELT is most fitting to address the purpose of this study. ELT guided this study in ascertaining the experiences of Science major students in their home-based laboratory activities in Microbiology.

This study will benefit the students to address their difficulties in conducting home-based laboratory activities, and teachers for them to be provided with the necessary information to effectively carry out and facilitate home-based laboratory activities amidst the pandemic. Moreover, this paper provides a theoretical discussion of Kolb's ELT, thereby, this paper adds to the concretization of Kolb's ELT theoretical constructs which were not elaborated further in previous studies.

Theoretical Framework

This paper was framed using Kolb's Experiential Learning Theory (ELT). ELT is divided into four-part theoretical constructs, such as concrete experience (CE); reflective orientation (RO); abstract conceptualization (AC); and active experimentation (AE) (Kolb D. 1994; Stocker, Burmeister, & Allen, 2014). This theory is a complete fit to guide the study in ascertaining the home-based laboratory experiences of students in Microbiology during the onslaught of the COVID-19 pandemic. Although ELT has traditionally been focused on the individual learner (Bleakley A. 2006), it can also be applied to groups of learners (Poore, Cullen, & Schaar, 2014). Kolb's ELT is a solid and widely accepted educational approach to the study that requires students to apply what they've learned through methods like simulation. Since students are frequently relegated to the roles of observer and not participant, it is critical that students could practice the skills acquired. In ELT, concrete experiences (CE) enable learners to participate in a group activity, such as doing real experiments and performing their roles. This performance serves as the backdrop for debriefing, in which learners reflect on their experience (RO), draw conclusions, and make decisions about future behavior. After debriefing, the learner can conceptualize the information gained from their experiences in observing and trying out new things (AC). The cycle is completed when behaviors and gained knowledge and skills are applied to future concrete experiences (AE). At the core of learning any

subject matter is a change in cognitive processes and reflection. Also, Kolb's ELT constructs were extracted using phenomenology by eliciting the lived experiences of Science major students with home-based laboratory experiments in Microbiology. Kolb's ELT framework provides support to determine how the students hypothesize and have trial and error in performing their experiments. This theory will also help the students to reflect on their experiences in conducting home-based laboratory experiments.

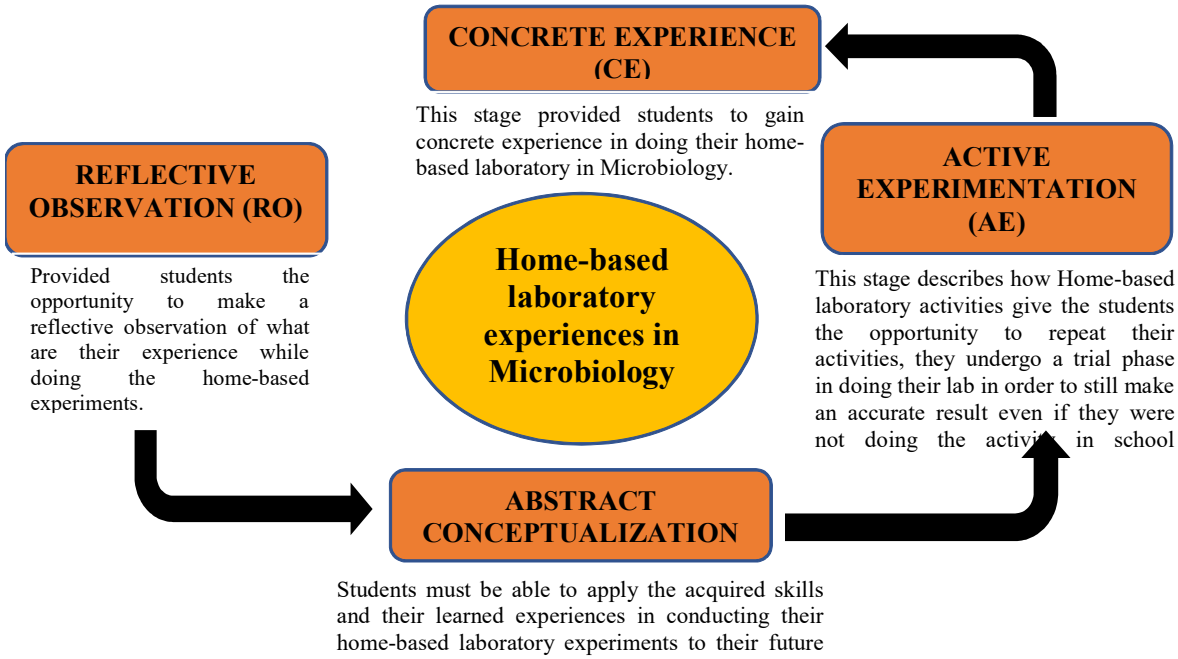

Figure 1. Kolb's experiential learning theory

Statement of the Problem

This study aims to determine the experiences of the students majoring in science in conducting home-based laboratory activities under the new-normal education using Kolb's ELT. Specifically, this study seeks to answer these questions:

1. What are the experiences of Science major students in conducting home-based laboratory activities in Microbiology?
2. How do Science major students use alternative materials and adapt strategies in conducting home-based laboratory activities?
3. What are the different skills acquired by the students in conducting home-based laboratory activities?

■ METHODS

Participants

This study was conducted at Isabela State San Mariano Campus. The informants/ participants were the 2nd year, 3rd year and 4th year BSEd Science students, allowing researchers to collect and analyze large amounts of data. The sample of 9 in this study was randomly selected purposefully because the research focuses solely on a single phenomenon (Lopez & Whitehead, 2013). Qualitative research frequently concentrates on small groups of those who have been thoroughly chosen as participants to take part since they have inclusive expertise in the topic under investigation. The goal of

purposive sampling is to pick students with data-rich knowledge who will provide light on the research issues. They are information-rich because they are unique in some way (Patton, 1990). The selection criteria are as follows: (1) Students must be enrolled in BSEd Science program for the Academic Year 2020-2021, and (2) they must be doing online learning and home-based laboratory activities.

Research Design

To determine the students' experiences in home-based laboratory activities, specifically, hands-on laboratory at home, the researchers used a qualitative research design. Qualitative analysis by Denzin and Lincoln (2000), implies a realistic approach and interpretive. This denotes that qualitative researchers to look into things in their real-world situations, and seek to make awareness of or understand events in terms of the gifts from the participants assigned to them. The researchers employed a phenomenological type of approach in determining the experiences of students in learning science-based laboratory activities at home in this new normal.

Phenomenological design is one of the types of qualitative research that focuses on the group's similar lived experiences. It is recommended to use in this study because of its unique potential to allow access to comprehension of "the meaning of a chosen human experience by describing the lived experience or phenomena as viewed by the participants." (Casey, p. 118, 2007). This study is a phenomenological perspective with a Hermeneutic design or Interpretive design. Smith Flowers, and Larkin (2009) define interpretive phenomenological analysis in its entirety: Interpretive Phenomenological Analysis is a qualitative research method that looks into how people interpret significant life events.

Research Instrument

A research interview's goal is to learn about participants' viewpoints, involvements, and individual beliefs on certain matters" (Gill. et al., (2008). And for the qualitative research, a point of view from scholarly named Sewell (n.d) state that this is an attempt to comprehend the world through the subject's perspectives, in order to decipher the significance of their involvements and expose their lives reality before explanations from science. Thus, the data collection in this study utilized a semi-structured interview with the goal of encouraging participants to reflect on and reconstruct their laboratory experience. Semi-structured Interviews are the most commonly used type of interview utilized by qualitative researchers, according to analysts (Alshenqeeti, 2014). This, semi-structured in-depth interviews can be done even with this pandemic, with the advancement of technology. The most commonly used methods are in person and telephone interviews (Jackle, Roberts, & Lynn, 2006). Aside from these two approaches, there are several others including emails and messenger interviews (Opdenakker, 2006). Variety of strategies was substantially aid in gathering the necessary data regarding the students' experiences from their home laboratory in order to achieve the same goal as a face-to-face interview. The interviewer is then given the opportunity to dig deeper into the interviewee's first commentaries, gaining a better knowledge of the issues raised.

Data Gathering Procedure

The researchers used a set of guidelines to carry out their investigation. The first step is planning; before carrying out this investigation, the researchers prepared a few strategies regarding the research procedures to be used. The researchers prepared well on reading materials

related to the study. The researcher prepared semi-structured questions that suits to answer the objective of the study. Second, the researcher conducted a survey interview, researcher prepared an agreement form for the participants of the study and the research was conducted right after learners and parents have been informed of the study and agreement has been obtained. They interviewed the participants using the prepared interview guide through, messenger interview and other audio-visual technological platforms as extensions of face-to-face interviews. Lastly, the researchers gathered and analyzed the data, in relation to this, the researchers sort out all the collected data using themes, coding, interpreted and present as text paragraph.

Data Analysis

The researchers employed qualitative thematic analysis to analyze the data. As independent qualitative descriptive approach, thematic analysis is primarily defined as a technique for classifying, studying and reporting patterns (themes) within data. (Braun & Clarke, 2006). As coding reduces the amount of raw data to be process relative to the study issue and splits it up into sections that are manageable (Forman & Damschroder, 2007; DeCuir-Gunby, Marshall, & McCulloch, 2011; Polit & Bech, 2010). As the researchers employ awareness to dig out the bottom line of the data and provide a higher-level logical explanation and interpretation, they acknowledge coding as one level of idea (Graneheim UH, Lundman B., 2004; Schilling J. 2006).

Ethical Considerations

The study considered the succeeding scopes of research ethics throughout the period of the study, taking into account the use of resources and time spent by the participants (1) Informed consent, this research was conducted right after the learners and parents has been informed of the study and agreement has been obtained. (2) respondents' vulnerabilities (3) and information confidentiality and privacy (all the interview responses were coded to make unidentified information/data that contains no evidence that could identify specific respondents in the study), and (4) transparency.

■ RESULTS AND DISCUSSION

The four themes were extracted from Kolb's (1984) Model of Experiential Learning Theory: (a) Concrete experience (CE), (b) Reflective observation (RO), (c) Abstract conceptualization (AC), (d) Active experimentation (AE). Each of these four themes is composed of several sub-themes that form part to the major theme.

Table 1: Shows the frequency of the response per sub-theme

Themes and sub-themes	Frequency
Theme 1: Active experimentation (AE)	
1.1 Repeating experiments at home when doing laboratory activities	8
1.2 Quality of laboratory outputs	4
1.3 Enjoying the freedom of performing/ doing all experiments	7
Theme 2: Concrete experience (CE)	
2.1 Doing laboratory activities at home	5
2.2 Sources of materials	9
2.3 Purchasing or borrowing materials	6
2.4 Similarities of school and home laboratory expenses	2
2.5 Teachers as facilitator	3
2.6 Instructions in the activity are not clearly stated	3

2.7 Preference of setting in doing home-based laboratory activities	7
Theme 3. Reflective observation (RO)	
3.1 Time performing and observing the experiment	7
3.2 Visiting YouTube video or links as bases for home laboratory activities	9
3.3 Abilities developed through working alone	9
3.4 Abilities developed through working with group mates	5
3.5 Factors that make it difficult to conduct and complete laboratory activities	2
3.6 Implementing the acquired skills	6
3.7 Availability of materials at home	6
Theme 4. Abstract conceptualization (AC)	
4.1 Following instructions	8
4.2 Acquired knowledge	6

Theme 1: Active experimentation (AE)

Subtheme 1.1 Repeating experiments at home when doing laboratory activities

All the participants in the study unanimously narrated their experiences in dealing with the online learning system where in they were asked to do laboratory activities at home. To begin with, all of the participants experienced repeating their home-based laboratory activities, they undergo a trial phase in doing their lab in order to still make an accurate result even if they were not doing the activity in the school laboratory, as Maan (F, 21) stated,

"*Yes, there are times that I have to repeat the activities. The reasons why I repeat my laboratory activity is that I am not satisfied enough, there is missing or mistake on the process or I did not attain the desired results."*

Subtheme 1.2 Quality of laboratory outputs

Aside from the accuracy and quality of the learning outputs, repeating of experiments also caused them to have doubt on the results of the home-based laboratory they have done as Melissa, (22) attested,

"*Kasi kung nasa school lab tayo yung result niya talaga magiging accurate, hindi tulad ng nasa bahay kase mga kwan lang mga pang sub lang na kagamitan so yung, para sakin, doubtful, parang di ako sigurado kung yun ba dapat ang magiging resulta nung laboratory naming"*

Repeating experiments is one of the things they have encountered while attempting to accomplish their home-lab activities. Trying out the experiments not just once but twice or more is one of their struggles just to get an accurate result and to succeed with their home-based lab activities.

Subtheme 1.3 Enjoy the freedom of performing/ doing all experiments.

Despite the struggle in accomplishing the laboratory activities in order to obtain an accurate result and maintaining a good quality of the lab through repeating the experiments, this gave the students the freedom to still enjoy performing and doing all the experiments alone, Roger (M, 21) recounted his experience,

"*Yes, because doing it all by myself means I can focus on what I am doing, no arguments to be raised, and my lab, my decision, and no one will interfere."*

There were some students who truly enjoy doing their home-based laboratory experiments,

and some of them still don't feel good performing the experiments at home, Jeraldine (F, 21) shared her thought,

"Not really. It's giving me frustration every time I can't successfully do it because of improper materials."

Some of the student-participants have similar experiences, they enjoy the freedom of performing and doing all the home-based laboratory experiments at home.

Theme 2: Concrete experience (CE)

Subtheme 2.1 Doing laboratory activities at home

Due to the sudden transition from none virtual face-to-face learning method inside the classroom to a digital simulated teaching system, even laboratory tasks that were formerly performed in a school laboratory were turned into online laboratory activities. And from this, students have collected various concrete experiences in doing their home-based laboratory experiments at home. Given that the experiments could not possibly be performed in the school lab with the complete and appropriate materials the students had to really prepare everything by themselves-the materials, Reinyer (M, 21) stated,

"*Since we aren't able to use lab materials, we provide for ourselves."*

The struggle of not having enough materials from their home makes it more difficult and challenging for the students to finish their home-based experiments.

Subtheme 2.2 Sources of materials

Some students have also shared that they don't have the materials at home that is the similar with what they usually used in the school laboratory. Thus, they have to find a way to still do the laboratory experiments through the alternative, improvise and substitute materials readily available to their kitchen at home, Pol Jay (M, 21) shared his experience,

"I used alternative materials available in our kitchen, instead of beaker I used glass cup, instead of test tube I used ordinary tube or just cup."

Being resourcefulness is a coping mechanism of the students in dealing with the shortage of materials to perform their home-based laboratory activities, it is a great help for the students to accomplish their lab. Almost of the students have been engaging themselves in finding alternative materials in their kitchen.

Subtheme 2.3 Purchasing and borrowing materials

Almost all of the participants affirmed that in order to conduct their home-based laboratory experiments, students experience pulling out money from their own pocket because they need to buy materials on the nearest town or barrow to their neighborhood if they could not find the needed materials in their kitchen at home, Jeraldine (F, 21), shared,

"There's no other option, you must find them. It's either you buy it or you borrow it from your neighbors."

Majority of the participants experience such inconveniences on the availability of the materials needed to perform the experiments. Almost all of the participants are buying and barrowing materials to accomplish the experiments.

Subtheme 2.4 Similarities of school and home laboratory expenses

To be able to conduct the laboratory experiments, students need to buy the needed materials. The expenses in doing home lab experiments are not different to the expenses in doing lab experiments in school,

"Gagastos kasi nga wala tayo sa school pero kahit na sa school naman tayo ganun din gagastos and bibili pa rin tayo kasi may mga kailangan talaga tayo sa lab na kailangan nating bilhin, kaya walang pinagbago kung

nasa bahay ka man or school mapapagastos ka pa rin."

Expenses from both the home-based and school laboratory experiments are all the same.

Subtheme 2.5 Teachers as a facilitator

Some of the students shared their experience on how do their teacher facilitate the learning process online. They say that their teachers are extending their help to the students, and they are all trying their best to support the learning needs of the students, Roger (M, 21) attested to this,

"Absolutely yes, our professors provide accurate instruction either sending a file of a specific lab or instructing us personally"

Subtheme 2.6 Instructions are not clearly stated

Aside from the difficulties in finding appropriate materials, students are also having a hard time understanding thoroughly the given instruction, in that case they are asking their teachers to be enlightened about the things they don't understand and the teachers are making themselves readily available in times that the students need a clarification from the processes needed to be done in order to perform well the given experiments, Maan (F, 21) shared her experience,

"Yes, I always kindly approach my teacher whenever there are issues and problems l encounter. I ask questions to understand it clearly."

Although the teachers are sending the instruction, there are some students who cannot follow the given instruction and they tend to ask clarifications from their teacher.

Subtheme 2.6 Preference of setting in doing home-based laboratory activities

The epidemic has had a huge impact on education, that causes in which educators and learners are being forced to switch from none virtual face-to-face learning method inside the classroom to a digital simulated teaching system, by the means of this act, adjustments are being done and there are lot of things that have been compromised. In relation to this, even laboratory tasks that were formerly performed in a school laboratory were turned into home-based laboratory activities. All of the students prefer and longing to have a face-to-face learning and teaching process because they are struggling from doing home-based laboratory experiments. Based on their experiences, home is not a conducive learning, Maan (F,21) revealed,

"*Home is not suitable environment to conduct the laboratory activity. For me, it is more convenient to conduct in science laboratory with teacher to facilitate and classmates"*

In general, most of the student-participants responded that learning inside the traditional classroom is way better than learning online.

Theme 3. Reflective observation (RO)

Subtheme 3.1 Time in performing and observing the experiment

Students were given the responsibility to do the household chores such us cleaning their house and other home-related work, and since the laboratory activities that were usually done at school and were now performed and observed by the students at their homes, this gave almost all of the students a lot of time and freedom to do their home-laboratory activities despite their house responsibilities, as Roger (M,20) stated,

"Yes, because it is done at home, I hold my time to how long I should do the lab, regardless of other matters and work at home. Therefore, I can still have time in performing and observing my experiment."

Aside from the freedom of choosing the time and how long it takes the experiments to finish, students feel less pressure are given enough time

in performing the activity, because they can repeat their experiments in home as Jeraldine, (f,22) stated,

"*Yes, I could say less pressure and more freedom"* There were also students who enjoy doing the home-based laboratory experiments as they can repeat their experiments until they achieved the desired results, as Mae (F, 22) stated,

"Isa pa dito is maraming oras para umulit kung baga trial and error na kailangan mo ng ilang trials bago mo maperfect yung gagawin"

Having the freedom to choose what time they would start to do their experiments and how long it takes for them to finish the experiments gave them the capability to use their time wisely and effectively, plus doing home-based laboratory experiments makes the students more comfortable as they can repeatedly perform the experiments as to how many times they want until they are satisfied and until the desired result are achieved.

Subtheme 3.2 YouTube videos or links as bases for home laboratory Activities

Watching YouTube videos or visiting links can help the students in conducting their experiments, they use it as their basis to gather ideas and knowledge in order for them to easily conduct home-based laboratory activities. Moreover, this helps them to understand the instructions and the processes involved in the given activity, as Reiner, (M,21) stated,

"I tried just to make a brief understanding about what is the process and what would be the expected results of the activity"

Not only that the students rely on watching YouTube videos and visiting links but teachers also recommend it to the students by inserting links on the file of a specific activities, as Roger, (M, 20) stated,

"Our professors either suggest us to watch video to have even more idea and knowledge about the lab or they insert YouTube links and the likes in the file they sent for easy access and smooth flow of the lab."

Watching YouTube videos and visiting links as a basis for their home-based laboratory activities is a great help for them to understand the processes involved in doing a specific laboratory experiment which leads them to easily conduct their home-laboratory activities.

Subtheme 3.3 Abilities developed through working alone

Working alone in doing the activity helps the students to improve or unleashed some of their skills. Most of the students have developed their skills in critical thinking, observation skills, resourcefulness and problem-solving skills, creativeness as well as self-independent, as Poljay, (F, 22) stated,

"Interesting, I think doing it alone helped me become the independent person I always wanted for myself, that I practiced solving problems on my own."

Most of the students that perform the activity in their home have develop and improved the skills of being creative, resourceful, self-independent, critical thinking, observation skills, problem-solving skills that would be helpful in their succeeding laboratory activities.

Subtheme 3.4 Abilities developed through working with group mates

Experience in working alone is far more different from working with group mates; it sets the students in a different behavior in order to work well with group mates. Working with group can have unforeseen circumstances such as conflicts, miscommunication, as Roger (M,20) stated,

"Many members mean many arguments, criticism of your performance may encounter a loss of focus due to members' attitudes. However, doing a lab in a group has also its positive side, more members means more ideas to share, you don't do the work by yourself, each member has their own work for the lab, and less time-consuming than the individual lab. Also, performance and the probability of the project to be graded at a high rate is increased."

But as students worked with the group in performing their activities, they develop skills like communication skills and collaboration skills as, Jeraldine (F, 20) stated

"I do it with a group, my communication and collaboration skills improve" All of the students have developed and improved skills based on their experiences in doing their home-based activity. They have developed a sense of solidarity and communication skills which is important because they maintain the ties that hold them together as it is when they are doing laboratory activities at school.

Subtheme 3.5 Factors that make it difficult to conduct and complete laboratory activities

Doing activities at home brings a lot of unwanted factors which will make it difficult for the student to finish or continue his/her activity, they may not finish it or they may just continue the next day. Most of the factors given by the students are the insufficiency of adequate materials, time, because some of the students have difficulty in dealing with time management, natural noises such as noise from different kinds of vehicles, and noise from the nearby neighbors and lastly the workplace since based on most of the students experienced, home is not a conducive place to conduct home-based laboratory especially the laboratory activities from Chemistry, as Roger, (M,21) stated,

"Insufficient Materials, Time, Noise, House Responsibilities, Area to do my lab" Doing home-based laboratory activities brings a lot of challenges to the students. There are difficult factors that make it hard for the students to conduct their lab activities, some of these are insufficient adequate materials, time, natural noises, and the environment in doing the laboratory.

Subtheme 3.6 Implementing the acquired skills

When students perform laboratory activities at home, they have developed individual skills and abilities from working alone and when working with group mates. These skills and abilities help them in their next laboratory activities as they can now easily analyze the instructions, master the steps or processes involved in a specific home-laboratory and most especially to improve to have a better lab result, as Pol Jay (M,20) stated,

"The skills I have acquired in doing my laboratory activities help me to perform the succeeding laboratory activities in the sense that I can get easily master the process despite the diverse laboratory processes. Also, in the later part of lab activities, the process gets easy and my performance as well is improved"

All of these student-participants have similarities in implementing their acquired skills, they are able to use them for their next activity wherein the acquired skills make it easier for them to read, analyze, and create a better output and results.

Subtheme 3.7 Availability of materials at home

In doing the laboratory activities at home, students are being force to produce their own materials given that the laboratory materials from the traditional lab at school cannot be transported in every student's house. It is a great privilege

for those students who can find all of the needed material at home, Jeraldine, (F, 20) stated,

"Yes, I completed every laboratory activity with the materials available at home" The struggle in doing home-based laboratory activities is doubled for those students who cannot find all the materials at home, as Maan (F, 20) stated,

"In doing my lab activities, my problem is the needed materials that is not available in our house"

Some of the students can complete their laboratory activities by finding all the materials at home, and for some, their struggle in doing home-based laboratory activities is doubled because of they can find all the needed materials at home.

Theme 4. Abstract conceptualization (AC)

Subtheme 4.1 Following instructions

Understanding the laboratory instructions is a great way to the success of laboratory outputs. Most of the participants in the study said that they have difficulties in understanding laboratory instructions, as Roger (M, 21) stated,

"Misinterpreted the instruction where we have not included some materials in the said lab" Most of the participants have the same experiences in following the laboratory instructions, they have difficulties in following the instructions because they misinterpreted the given instructions.

Subtheme 4.1 Acquired knowledge

Students know that the success of their home-based laboratory activities lies within their hands, as Roger (M, 21) stated.

"You have been given the opportunity to deal with these activities on your own, by any means necessary, you have in your hands the future of your lab works, their outcomes, as well as what level of knowledge and performance you have invested in that lab."

Students have a sense of responsibility for the outcomes of their home-laboratory activities.

This study aims to determine the experiences of science major students in conducting home-based laboratory activities in their microbiology subject under the new-normal education. Nine (9) participants were qualitatively interviewed using Kolb's Model of Experiential Learning. The model is well-known for its holistic approach to student learning, which includes action/reflection and experience/abstraction. (Kolb & Kolb, 2011). The experiential learning cycle is divided into four stages: concrete experience (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE) (Kolb & Kolb, 2011). The cycle has no beginning or end point, guaranteeing the students can begin at any point.

The rapid transition in teaching format caused by COVID-19 creates many challenges, particularly for research and laboratory activities, which may require a different approach with more limited resources than lecture-based courses, in which various virtual communication is now used. Participants of this study have experienced difficulties in doing home-based laboratory activities. During stage 1, active experimentation, home-based laboratory activities give the students the opportunity to repeat their activities, they undergo a trial phase in doing their lab in order to still make an accurate result even if they were not doing the activity in school laboratory this supports the idea of Reeves and Kimbrough (2004) wherein, he narrated those activities carried out at home allow the student to prolong their observations over a longer length of time. The most crucial benefit is that it is convenient for students. Based on learners from the surveys of online laboratory courses, the significance of efficient management of time in the course that has links to the laboratory activities and assessments for the students to monitor their time in finishing and finalizing their hands-on laboratory at home has been highlighted. Home laboratory activities, like other aspects of distance education, allow students to avoid time-consuming

excursions, study when and where they choose so that they may balance work, family, and social obligations, work at their own pace, and repeat observations as needed (Cancilla & Albon, 2008). Aside from this, eScience laboratories, where experiments are carried out at home through the help of virtual lectures, animations, and a science laboratory manual, are another alternative to a non-traditional lab (eScience Labs, 2014).

Stage 2 provided students to gain concrete experience in doing their home-based laboratory in Microbiology. Due to the inconveniences on the availability of the materials needed to perform the experiments, students provide their own laboratory materials by buying, borrowing materials or they used the available materials at home to accomplish the experiments is supported by Casanova and Civelli (2006), and Lyall and Patti, (2010) who stated that hands-on laboratory omitted to employ kit for the laboratory; instead, the thing is that they used common home objects in a manner alike with "kitchen chemistry" method. Though an online laboratory, such as a hands-on laboratory at home, has many benefits for students, it also has drawbacks and obstacles, for instance, time spent looking for apparatus and a lack of close monitoring, as evidenced by Etkina, Murthy, and Zou (2006).

Stage 3 provided students the opportunity to make a reflective observation of what are their experience while doing the home-based experiments. Misinterpreting the instructions given to them is also one of the students experienced, thoroughly analyzing the given instructions made the students think critically, following guidelines when conducting home-based activities that guarantee students learn abilities that are both transportable and current that support the idea of Ma and Nickerson (2006) that laboratories are excellent for instruction manipulating skills and learners' exposure to open-ended environments that promote inquiry and creative thinking. The students have also experienced visiting YouTube and links as their bases for their home-based laboratory experiments was supported by eScience Labs, (2014), where experiments are carried out at home through the help of virtual lectures, animations, and a science laboratory manual, are another alternative for a non-traditional lab (Tatli, 2009).

Abstract conceptualization, stage 4, provided evidence that students understood what they needed, Aside from these, the students have developed their self-esteem and creativity in doing home-based laboratory activities this supports the findings of Townsend (2012) wherein, she imparted that hands-on science has a bigger effect on knowledge than on attitude in young students, and this leads to students not only gaining skills in science through outside learning, but also transferring their knowledge and skills to other topics. The students also participate effortfully in the investigation task and build process skills and knowledge in science via hands-on distant labs (Wieman, 2015). This deep engagement of the students also strengthens the lab course's goal which is frequently to teach self-development skills and safety precautions, as well as transferable abilities including collaboration, administration of the time, communication, and resolving conflicts (Boyer, 2003; Woods, Felder, Rugarcia, & Stice, 2000) and encouraging the acquisition of information (Casas & del Hoyo, 2009).

Students must be able to apply the acquired skills and their learned experiences in conducting their home-based laboratory experiments to their future practice, and this study was able to prove their capability to do so, this supports the statement of Josephsen and Kristensen (2006), wherein students using SimuLab in an inorganic chemistry course found it to be a motivating tool that enhanced their skills and helped them see the practical application of their knowledge.

The themes reflected that the students had become more knowledgeable enough in having a reflective observation of what was their

experiences in conducting home-based laboratory experiments and recognized what are their acquired skills in working alone and working with their groupmates. The students noted difficulty in doing their home-based laboratory activities for they struggle on not having enough materials from their home makes it more difficult and challenging for the students to finish their home-based experiments. Most importantly, students were able to identify opportunities where they can apply the acquired skills and knowledge. The student's difficulty in doing home-based laboratory experiments is apparent in the data. Utilizing Kolb's framework appears to have highlighted the different experiences of the students dealing with their difficulties, reflection and acquired skills in conducting home-based laboratory in Microbiology.

■ CONCLUSIONS

Applying Kolb's framework emphasized the different experiences of the students dealing with their difficulties, reflection, and acquired skills in conducting home-based laboratory activities in their Microbiology subject. Students prefer doing laboratory activities at school rather than conducting them at home. Students have also developed their skills in performing laboratory activities at home such as creativity, self-developmental skills like resourcefulness, self-esteem, and critical thinking, they also have much time in conducting and observing the laboratory activities. The students have also used their acquired skills and knowledge from the past activity in the current home-based laboratory activities. They also have the opportunity to repeat laboratory activities if they are not satisfied with the results. Participants of this study boost their self-esteem wherein they learn to become more independent in doing or completing their laboratory activities.

Since online laboratory was being implemented, it is suggested that teachers may authorize the students to borrow laboratory equipment for the students to lessen their struggles in finding alternative materials. The university may also allow the students to conduct face-to-face laboratory activities if they cannot allow them to borrow laboratory equipment or materials while observing the health and safety protocols of the pandemic.

The limitation of this study is the fact that the two groups of participants were not from the same year level. Although the lab was run by the same instructor in both years, different teaching assistance was involved, which may have influenced the results. The student's experience with home-based laboratory activities was limited to Microbiology subject only. Furthermore, a comparison of home-based and traditional laboratory experiments would be proposed for researchers who are interested in following-up this study.

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