INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print) 2222-5234 (Online)
http://www.innspub.net
Vol. 22, No. 6, p. 149-164, 2023

RESEARCH PAPER OPEN ACCESS

Adapting laboratory teaching for flexible learning: addressing challenges during the COVID-19 pandemic

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Key words: Challenges, COVID-19 pandemic, Flexible learning, Laboratory subjects

http://dx.doi.org/10.12692/ijb/22.6.149-164 Article published on June 13, 2023

Abstract

The implementation of Flexible Learning in various educational institutions amidst the COVID-19 pandemic poses many struggles, particularly in teaching laboratory subjects. This study aimed to explore the challenges experienced and encountered by teachers in teaching laboratory subjects in times of pandemic, particularly during the First Semester AY 2020 – 2021 in one of the universities in Tacloban City, Leyte, Philippines – wherein Flexible Learning Modality (FLM) was implemented. The study utilized a qualitative research design, particularly phenomenology, involving ten (10) teachers handling laboratory subjects. An in-depth interview was employed using an interview protocol that guided the researcher in gathering data. Based on the result of the study, there were three distinct themes emerged, such as; (1) technology and laboratory set-up challenges, which includes communication, lack of access to internet connectivity, limited access to technology such as gadgets and other devices; (2) students-readiness related challenges, which includes students' readiness, submission of outputs, difficulty in following instructions, and the difficulty of some learning activities and assessment; and (3) teaching-learning process-related challenges which include the lack of preparedness for instruction, difficulty in assessing and providing feedback, and difficulty in establishing the validity of written outputs. Furthermore, an intervention plan was proposed based on the result to address the identified challenges appropriately. Moreover, it was recommended that the proposed intervention be implemented to address issues and concerns in the implementation of flexible Learning. Further studies utilizing other methods and contexts were also recommended.

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Introduction

Coronavirus disease (COVID – 19) has been a very challenging health concern that affects people all around the globe. The significant impact of the pandemic is on the education sector, from primary education to higher education, since the student cannot be physically present in school due to the implementation of government policies to suspend face-to-face classes in different countries, including the Philippines. Furthermore, the science curriculum aims to promote fitness, health, and wellness by engaging students in different programs and various laboratory activities. However, the COVID-19 pandemic is pretty challenging for the teachers since face-to-face interaction with students is not allowed. Teachers have no choice but to adopt flexible learning modalities. In the said university, Flexible Learning Committee (FLC) was created to respond to the Commission on Higher Education (CHED, 2020) to facilitate the implementation of flexible learning in the university, and different approaches like online learning and modular learning modalities were implemented.

Implementing Flexible learning (FL) in various educational institutions poses many challenges, particularly on courses that involve laboratory subjects, which is best learned through face-to-face encounters. Applying the flexible learning in laboratory subjects is something new, particularly in the university context. Moreover, considering the concept of continuous improvement, it is vital to explore the issues and concerns inherent to its implementation to see the new realities, look unto this aspect, and formulate mechanisms to address them appropriately. Additionally, this study aims to provide evidence-based information in formulating an intervention plan to improve the delivery of instruction using the flexible learning approach, particularly in laboratory subjects.

The COVID-19 pandemic forced colleges and schools to close their doors, affecting an unprecedented number of students worldwide (UNESCO, 2019). During the pandemic, it was noted that the academic performance of students was deteriorating. With the increase of existing socioeconomic disparities affecting learning and outcomes, it can be contemplated that there is growing educational inequities (García & Weiss, 2017 as cited in Garcia & Weiss, 2020; United Nations, n.d.). Moreover, due to the pandemic, community quarantine was established resulted in the prohibition of face-to-face classes (Simbulan, 2020). Moreover, CHED (2020) has established guidelines for implementing Flexible Learning (FL) to resume classes for HEIs despite the pandemic, and one of the modalities introduced was modular learning, which was considered as the most preferred mode of instruction by parents for their children (Malipot, 2020). However, there are challenges identified in various literature. Accordingly, modular learning may not work for some students since some of them cannot read and comprehend independently (Perez, 2020). Other challenges were identified with the implementation of FL are related to preparing the lesson, conduct of classes, internet use, evaluation of students learning, and virtual classroom behavior (Mayol, 2020). Specifically, in modular learning, Dangle & Sumaoang (2020) have identified some of the challenges encountered by teachers, like students may not able to study independently, late submission of outputs, difficulty in printing and reproduction, the validity of learner's answers in the learning modules, and the bulk of paper works. In teaching laboratory subjects, various scholars have identified different challenges encountered by educators.

These challenges include: challenges related to the increased numbers of the students in the classroom or large class size (Betram & Kaleeswaran 2017; Oudat, 2016); challenges of the abilities, devices/ instruments, and equipment particularly inadequate trained or lack of competent teachers, lack of facilities, equipment, and materials for teaching (Betram & Kaleeswaran, 2017; Edward, 2015; Oudat, 2016); challenges related to the content of the academic curriculum particularly on the quality of instruction of physical education is not delivered, and lack of professional preparedness (Betram & Kaleeswaran, 2017; Edward, 2015; Oudat, 2016) challenges related to the school environment (Oudat, 2016), challenges related to the school management.

(Oudat, 2016), time allocation is not sufficient (Betram and Kaleeswaran, 2017), and teachers have a negative attitude towards teaching PE (Edward, 2015). In addition, Betram and Kaleeswaran (2017) noted that the time allocation in the school curriculum for PE has been diminishing around the globe.

The implementation of Modular Learning as one of the Flexible Learning Modalities also took place in this university. This flexible learning is to be delivered using emails and on-campus pigeon boxes (OCPBs), File Transfer Protocol (FTP). Teacher-Initiated Phone (TIP) calls, and Student-Initiated Phone (SIP) calls, which complement the modular learning modality. At present, no known study explicitly conducted to the challenges teachers encounter in teaching laboratory subjects utilizing the modular learning modality amidst the COVID-19 pandemic. Furthermore, it can be observed that implementing the modular learning approach has been a very challenging experience among teachers, various complaints, and verbalization of inconvenience I have overheard from my colleagues. Moreover, the COVID-19 pandemic provides a new perspective in teaching with the implementation of modular learning, and varied experiences among educators, especially those teaching laboratory subjects in the context of the university, prompted me to explore this phenomenon and conduct this study.

Hence, this study was conceptualized to explore the challenges encountered by teachers in teaching laboratory subjects utilizing a modular learning approach amidst the COVID-19 pandemic. This study will serve as a basis for developing an intervention plan to improve the teaching-learning process, improve the quality of instruction, and ultimately facilitate the attainment of learning outcomes among learners.

Research Objectives

Generally, the primary purpose of this study was to explore the actual challenges encountered and experienced by the teachers in teaching laboratory subjects amidst the COVID-19 pandemic during the first semester of AY 2020 – 2021 in one of the universities in Tacloban. Specifically, this study aimed to achieve the following objectives:

1. determine the challenges encountered by teachers in teaching laboratory subjects utilizing Modular Learning Modality in times of COVID-19 pandemic, and
2. develop a proposed intervention plan.

Materials and methods

Research Design

This study utilized a qualitative research design, specifically the phenomenology approach. Qualitative research is a systematic empirical inquiry on the meaning or subject of inquiry (Shank, 2002 as cited in Ospina, 2004). Some of the advantages of qualitative research are its sensitivity to contextual factors and increasing opportunity to develop new ideas and theories (Conger, 1998; Bryman *et al.*, 1988; Alvesson, 1996 as cited in Ospina 2004). Among the qualitative designs, phenomenology was deemed appropriate for this study since it involved descriptive accounts of teachers' personal experience in teaching PE in a particular phenomenon: the COVID-19 pandemic. Phenomenology can be used to study the human experience and structures of one's consciousness as experienced based on the first-person point of view (Smith, 2008 and Sokolowski, 2002 as cited in Gallagher, 2012). Moreover, to describe the challenges encountered by teachers teaching laboratory subjects in times of pandemic, I took the descriptive account of the participants about the phenomenon based on their responses in the in-depth interview.

Research Environment

The study was conducted specifically in one of the universities in Tacloban, Leyte, Philippines. As of AY 2020 – 2021, the said university, has three colleges, the College of Education, College of Arts and Sciences, and the College of Management and Entrepreneurship, offering different degree programs. Furthermore, preparatory, elementary, Junior and Senior High School Basic Education Curriculum were also offered, serving as laboratory school under the College of Education.

This university implemented FL modalities such as modular learning and online modalities. During enrolment, students were asked to select which of the two learning modalities they would prefer, whether Online Learning Modality (OLM) or Modular Learning Modality (MLM). As of the first semester of AY 2020 – 2021, the student population in LNU was 5,700. Of which 3,990 (70%) were preferred in online learning modality, and 1,710 (30%) selected modular learning modality. The total number of faculty members is 189, composed of 129 faculty members with permanent status, 31 with temporary status, and 29 part-time lecturers. Among the faculty members, 33 are handling laboratory subjects at both secondary and tertiary levels.

Participants

The participants of this study are 10 faculty members teaching laboratory subjects in Science and Information Technology subjects. The participants were selected through total enumeration. The researcher believed that the teacher participants of this study have the knowledge and inputs for the completion of this study since they have first-hand information based on their experience on the challenges, they encountered in teaching laboratory subjects.

Instrumentation

The researcher utilized an interview protocol employing semi-structured interviews to facilitate the data gathering to answer the research questions. An interview protocol was used to guide the conduct of an in-depth interview. An interview protocol is a procedural guide for directing qualitative research through the interview process (Jacob & Furgerson, 2010).

Data Collection Procedures

The data collection involved a series of events. First, the researcher wrote a letter to the teacher respondents asking permission to conduct the research study and for the administration of the in-depth interview with the faculty members teaching laboratory subjects. Then, the researcher personally talks to the participants to set a schedule for the interview while explaining to them the purpose of the interview and the study. A consent letter was also prepared to explain to the participants the purpose of the interview and their role in the completion of the study. As the participants agreed, the informed consent was secured by asking them to affix their signatures on the consent form. With the participants' agreement considering their availability and convenience, the researcher set the interview schedule.

The interview was conducted through Google Meet to consider the present situation in which face-to-face interactions were discouraged. The researcher sent the Google Meet link to the participant as scheduled and again explained the purpose and mechanics of the discussion. During the interview, the researcher recorded the session with the consent of the participants through Tactiq for Google Meet Transcription application for documentation.

After the interview, the transcript was prepared, and a copy of which was sent to the respective participants to review the accuracy of the information they had provided. Moreover, the data gathered was treated with utmost confidentiality, and the anonymity of the individual participant was considered throughout the research study.

Data Analysis

The researcher used Inductive Thematic Analysis to analyze the data. Thematic analysis was "a process of identifying patterns or themes within qualitative data" (Maguire & Delahunt, 2017, p. 3352). Moreover, Colaizzi's descriptive phenomenological method was used in the analysis of data to reveal the "essence" or "essence structure" of the phenomenon (Morrow, Rodriguez, & King, 2015). Colaizzi has identified seven steps on the process providing rigorous analysis such as familiarization, identifying significant statements, formulating meanings, clustering themes, developing a detailed description, producing the fundamental structure, and seeking verification of the basic structure (Morrow *et al.*, 2015).

Following the steps provided by Colaizzi as presented in Morrow *et al.* (2015), the data gathered was collated, and the transcription was plotted in Microsoft Excel. Sorting and organizing the data

allowed familiarization which enabled the researcher to identify significant statements to facilitate analysis and reveal its meaning or "essence." A code was provided for each account, and group them according to categories or themes. Then the researcher clustered the themes that emerged from the analysis, and I analyzed meaning on the different themes shared across the narrative accounts. After clustering the themes, the researcher wrote an inclusive description of the phenomenon; then, the researcher condenses the detailed report into a short statement capturing salient aspects essential to the phenomenon's structure. After analyzing the data, the narrative accounts were reviewed and ensured that the results captured the essential points of the narratives.

Upon analysis, the researcher ensured that the information provided by the participants was accurate based on the information they had provided and made sure that the data was free from bias, neutral, credible, and valid. The researcher ensured the study's trustworthiness considering the credibility of the participants and the information they have provided. Dependability was considered by using appropriate technology in the gathering of data to ensure the accuracy of the result. Moreover, conformability and transferability were also emphasized by ensuring that the data collection process, analysis, and interpretation of data follow appropriate process and rigor of research.

Results

Challenges Encountered in Flexible Learning Modality

Three distinct themes emerged based on the result of the study. The following themes were identified: (1) technology and laboratory-related challenges; (2) students-readiness-related challenges; and (3) teaching-learning process-related challenges.

Theme 1. Technology and Laboratory-Related Challenges

Generally, the participants employed the modular learning and online learning modalities in their laboratory classes. The common practice among the participants requires students to enroll in the google classroom intended for the specific subject. The students may access, download, and store the electronic copy of the Flexible Learning Package (FLP) into their respective smartphones or any device from the classroom and work on various learning activities. With this practice, there are challenges encountered relative to communication difficulties, lack of access to internet connectivity, and technology such as gadgets like cellphones, laptops, and other technological devices that aid in implementing the modular learning modality.

Sub-theme 1.1. Communication-Related Difficulties

At the initial stage of the teaching-learning process, challenges have already emerged, particularly in the distribution of the learning module. Participants presented that some students do not own cellular phones, the contact number cannot be reached, and cannot be communicated. Three of the participants expressed that:

"I have communicated and contacted 80% of my students, and the others cannot be contacted. I called them...but their contact numbers cannot be reached." (Participant 001)

“Not all of them can be communicated...it is really the biggest challenge or difficulty that I encountered during this modular learning.” (Participant 002)

"I noticed that some students do not join the google classroom. I called them every week, I even texted them, but still, some cannot be reached.” (Participant 003)

“Although virtual labs, remote control labs or video-based labs are good choices when students are not physically located on campus but many students cannot follow and understand the online procedures.” (Participant 004)

“Remote laboratories allow the undertaking of experiments through the internet, whereas video-based activities provide a step-by-step overview of a real lab but students cannot visualize and have difficulty visualizing the whole experimental process and its environment through a video”. (Participant 005)

"Although in most cases, online teaching and laboratory practices in the laboratory field are often more effective than traditional based learning but when given online or modular, my students did not fully understand and develop skills when given in flexible modalities because of communication difficulties". (Participant 006)

"Communication between the teacher and the students is limited in Flexible Learning. Access to communication to some students must be in place to facilitate the teaching-learning process to communicate issues and concerns regarding the teaching process. The result emphasized that a barrier exists in terms of communication, aside from the fact that students and teachers have limited interaction due to the learning modality used. The situation was aggravated by the lack of communication among students due to network limitations in isolated areas. Some students do not even own any communication device. This challenge may also be attributed to factors like the information, or contact number they have provided during the enrolment is not functional. They don't own the number, or the cellphone signal may not reach their location.

The result implicated the importance of communication between the students and the teacher. It plays a crucial role in giving instructions, feedback, and even addressing students' concerns should problems arise in accomplishing the learning modules.

Sub-theme 1.2. Students' Lack of Access to Technology and Internet Connectivity

Modular learning in the JRMSU context requires the student to have an internet connection for them to be able to download the learning resources. Teachers must ensure that all the students have access to learning resources to do all the required learning activities. However, it was a challenge among participants when not all students had access to an internet connection. This challenge refers to a situation in which students have difficulty in accessing learning resources from the Google classroom, lack of access to the internet, inability to upload videos, failure to submit outputs in the Google classroom, students not owning any gadget, and some may have but lack of appropriate specification required to be able to accomplish the learning activities. Some of the participants stated that:

"Some of them were not able to log on online through google classroom, and some were able to access, but it took them time... One of my students told me that he only borrowed a cellphone from a friend." (Participant 002)

"The very first problem is internet connection...As an instructor, I also wanted to reach out to students. They have this Android cell phone so, I tried to have a video call with them one by one. I say that internet connection is one problem or one of the challenges. It's difficult because students do not have the gadgets, and it is not accessible for them. That is why it's challenging to the part of the teacher on what strategy he will be using to at least reach out their students." (Participant 003)

"Students have a hard time on editing videos and also in uploading it because some of our students do not have a strong internet connection, and they're always worried that they cannot upload their videos." (Participant 005)

"It's tough for us to communicate with students. When there is unstable connection during the submission of activities." (Participant 006)

Participants complemented the modular learning with learning activities wherein students have to watch video tutorials and demonstrations to facilitate the acquisition of skills, video recording of a performance, and submission of outputs. These activities require students to have access to appropriate technology and internet connectivity. In some instances, teachers even integrated these activities into the learning modules. Thus, it is challenging since some students lack access to technology and stable internet connectivity.

The result denoted that access to appropriate technology and internet connection in distance

learning, particularly in Physical Education, plays a significant role. It also provides insights that modular learning may not be sufficient in learning laboratory and needs supplemental activity requiring appropriate technology and internet connectivity.

Theme 2. Student-Readiness Related Challenges

Students-readiness-related challenges refer to the difficulties encountered by the participants in terms of students' readiness for independent learning, submission of outputs, difficulty in following instructions, and difficulty of some learning activities and assessments. In implementing the Modular learning modality, various challenges were encountered by the teacher related to student readiness.

Sub-theme 2.1. Lack of Students' Readiness for Independent Learning

The participants encountered this challenge relative to students' readiness to learn independently through modular learning and lack of preparedness to use technology-mediated instruction such as Google classroom**.** In Modular Learning, students become more independent in learning with less intervention from the teacher. Moreover, participants verbalized their concerns as they encountered challenging experiences in this aspect. Participants verbalized that:

"The students themselves are not that ready to face this type of teaching, this modular type of learning…Why? Because there are those students who are not doing their tasks in their modules." (Participant 003)

"I think they were not ready yet. They're not yet ready for this approach…this kind of approach… this modular." (Participant 006)

"I think they are not ready because they are not even familiar even with the Google classroom." (Participant 005)

The abrupt suspension of face-to-face classes due to the COVID-19 pandemic forced educational institutions to offer flexible learning. The result elucidated the importance of students' readiness. Students have no option but to dwell on the available learning options, although assessment of their capability in terms of their mental, psychological, emotional, and other dimensions were not considered to ensure their preparedness in this mode of learning.

Sub-theme 2.2. Late Submission of Students' Outputs

This challenge describes the situation encountered by the participants relative to students' late submission of outputs since some of them have technical difficulty on compliance, and some have taken advantage of the flexibility of time in which the imposition of a deadline was discouraged. Participants reported that:

"We are flexible, meaning we don't need to push or force students to pass the outputs even it is already the deadline…they think that it's okay to pass all the requirements days or weeks before the end of the semester." (Participant 001)

"There are those students who are also very impossible to turn in their outputs, which sometimes I feel like I do not know how to deal with them…some of them will tell you that they already submitted it, and when you look at the classroom (Google Classroom) it is not there." (Participant 004)

"Students cannot pass their outputs in a scheduled time." (Participant 005)

"I asked my students to submit their output on the Google Classroom; however, there were no submissions there." (Participant 006)

This information provided insights on the importance of setting clear guidelines and submission within the students' capacity and capability. Outputs submitted help teachers monitor students' progress, provide feedback, and come up with remediation if needed. Furthermore, the data suggested that some students are not prepared and lack technical competence in using technology such as google classroom for submission of outputs. Submission of output can be considered an essential part of modular learning since it provides the opportunity for the students to present evidence that

they have done what is asked of them and aid teachers in monitoring students' learning and progress.

Sub-theme 2.3. Students' Difficulty in Following Instructions

In the FLP, there are various learning activities that the students need to do as it contains all the necessary information for them to read and understand. However, participants have encountered a challenging situation in this aspect. This challenge refers to the student's difficulty following and understanding the instructions and the inability to submit correctly done output. Participants shared that:

"I think there is a problem in understanding the instruction." (Participant 002)

"The problem with the output submitted is that students did not properly do it. So, I think it has something to do with the instruction, and I don't know if they read instruction or choose to read part of the instruction only." (Participant 001)

"It is very challenging when you're trying to give your best so that the student will be able to understand all the instructions on the activities. But then, some students find it very difficult even though the instructions are straightforward." (Participant 004)

The data pointed out the importance of providing instructions based on the students' level of understanding. Instructions are crucial as it guides on how students can do certain activities. It can be noted that students may have issues with their literacy skills, such as understanding and following instructions in the learning module. This result can also be linked to the student's preparedness since students are not used to engaging in independent learning, wherein they have to learn with less teacher intervention.

Sub-theme 2.4. Difficulty of Some Laboratory Activities

This challenge refers to the situation in which the participants encountered students complaining about the difficulties of some laboratory activities in the learning module. Participants noted that there are activities in the learning module that the students find very difficult without the guidance of the teachers. It was pretty challenging on the part of the teacher. Some of the participants narrated that:

"I know that they (students) also face challenges in dealing with the lessons in the module…because there are lessons which I know that it is not easy for them to understand or to comprehend." (Participant 001)

"There are those difficult activities for the students to do without the guidance of the instructor." (Participant 009)

"There are students who find it very difficult, and they will tell you that it's tough." (Participant 010)

The result illuminated the importance of designing and developing learning activities which the general population of students can do. The result indicated that some of the learning activities may be too difficult for some students and may be related to a lack of readiness to work alone, lack of comprehension and understanding such as the instructions, and the complexities of the instructions in the learning activities.

Theme 3. Teaching- Learning Process Related Challenges

The participants encountered challenges involving the teaching-learning process, such as lack of preparedness for instruction among teachers, difficulty in assessing and providing feedback, and difficulty in establishing the validity of the written outputs. Despite the COVID-19 pandemic, teachers ensured continuity of learning with the implementation of Flexible Learning. However, as reported by the participants, there were challenges they have encountered in this aspect.

Sub-them 3.1. Teachers' Lack of Preparedness for Instruction

This challenge refers to lack of readiness among teachers to utilize a modular learning approach, lack of preparedness, unavailability of learning modules, and unpolished learning modules containing an error and unrealistic learning activities. The delivery of instruction in laboratory subjects using MLM was a

new experience for the teachers. Participants expressed their concerns on how it should be delivered effectively. Some of the participants conveyed that:

"I was not prepared because I didn't see it coming. I became disoriented at first" (Participant 001)

"The very first thing you need to do as a teacher teaching laboratory subject is you need to study your lesson...with current situations...I rely on the text, and then that's it. Just waiting for the outputs of the students, that's all. In LNU, we revised our laboratory manual to cater and fit to flexible learning" (Participant 004)

"I have a hard time with regards to teaching laboratory subjects because I am not used to having a modular teaching in this subject. We are not used to this, and we are still adjusting." (Participant 005)

"The challenge on my part is finding laboratory activities that could be performed offsite, like laboratory activities which can be simulated since it is not done in a real laboratory room". (Participant 10)

Some of the teachers who are not used to conducting laboratory subjects online specially the new ones expressed their concern about teaching these subjects using modules and other flexible materials. One of the participants remarked that:

"It's challenging because this is not really my major, but I tried my best, and then I also communicate my previous instructor... on what I am going to do?... I ask for a learning module for science laboratory subjects from other institutions. I ask here in my school, but they cannot provide the module and manual yet since it is still being prepared, but the class has already started." (Participant 009)

In another instance, participants expressed concern about the preparedness of the learning module to be used in the instruction. One participant shared that:

"Some video links are not for free; it needs to be purchased. Other activities, I saw it, and they are not that realistic." (Participant 004)

The result indicated that preparedness for instructions in laboratory subjects considering the teacher and the learning modules was not entirely in placed since the participants encountered some issues. Furthermore, the result emphasized the importance of preparation considering the teacher's preparedness and availability of learning resources. Understandably, time constraint was experienced in preparing the learning materials, from conceptualization, development, finalization, reproduction, to distribution. However, school management should give it much attention since the quality of instruction is at stake.

Sub-theme 3.2. Teachers' Difficulty in Assessing and Providing Feedback

This challenge described the situation in which participants could not see students performing the laboratory activities, being unable to correct the execution of students if there were mistakes, and being unsure if students learned the skills, they wanted them to know. Participants expressed their concerns about these aspects with the implementation of FLM. Some of the participants mused that:

"I'm not that sure if they are doing their job or not...the most challenging part of a laboratory subject teacher... there are lots of activities that require the student to do laboratory exercises, and you cannot see them performing those activities, and that's very difficult." (Participant 002)

"Assessing their skills would be quite questionable because I am not sure if they do get the Skills that I wanted them to learn." (Participant 001)

"You cannot directly correct them. When they are performing it right or in the wrong way." (Participant 005)

The result pointed out the importance of assessing and feedbacking as an integral part of the teaching-learning process. In teaching laboratory subjects, using a modular approach was a challenge since participants could not directly observe them performing. Instead, teachers asked for evidence such

as pictures or videos. However, there were also limitations among students. Assessments in laboratory subjects are primarily performance-based, and a modular approach may not be efficient as laboratory subjects require students to demonstrate and perform skills. Furthermore, this implied that flexible learning like modular learning in teaching laboratory subjects is challenging, especially in terms of assessment and feedback.

Sub-theme 3.3. Difficulty in Establishing Validity of Students' Written Outputs

Submission of outputs served as evidence that the students are doing their tasks and learning important concepts as they go over the modules. However, with the absence of teachers who guide and watch over the students as they do the different activities, the student's output's validity and quality would be at stake. It was a challenge that the participants expressed during the interview. This challenge refers to the reduction of quality of teaching and learning, lack of validity of outputs, and the existence of dishonesty such as copying of output of other students. Some of the participants imparted that:

"Many things were lost during the pandemic. With the modular approach, the quality of learning was also reduced. Another challenge is the validity of students' performance; I mean the validity of their outputs; how honest did they perform their tasks. I know that it's not 100% valid and reliable." (Participant 001)

"I'm not that sure if they are the ones who are doing their output or not." (Participant 003)

"I've seen a lot of copied and similar answers written activities from their classmates." (Participant 006)

In flexible learning, it is challenging to ensure the validity of results, especially in students' written works. The resources online are available, and the student may copy and paste it on their output without even trying to understand the concepts and, worst, copying answers from their classmates, which is very common. It is somehow a trend among students nowadays that depleted the purpose of various learning activities that supposedly trained them to acquire critical thinking and other higher-order-thinking skills by simply copying from a source without even thinking. It is a great challenge for teachers to instill academic honesty among students.

It implicated the importance of establishing the validity of written outputs done by the students. Ensuring the validity of works also provides the quality of students' learning. It allows them to write their creations utilizing high-order-thinking skills as it operates while conceptualizing their written works.

Discussion

This study explored the challenges encountered by the teachers in teaching laboratory subjects utilizing FLM amidst the COVID-19 pandemic. The findings indicate that various challenges have been encountered in different aspects, which can be categorized into (1) technology and laboratory-related challenges, (2) students-readiness related challenges, and (3) teaching-learning process-related challenges.

Technology and Laboratory-Related Challenges

Although the said university implemented the flexible modular learning approach in teaching laboratory subjects, we cannot undermine the role of technology as it plays a vital role in complementing any approaches in distance learning, including FLM. The technology used for communication between the students and the teacher facilitates giving instructions, feedback, and even addressing students' concerns should problems arise in accomplishing the learning modules. However, communication becomes a challenge for teachers due to students' limitations on this aspect. The result validated the information provided in Niñal (2020) that many students in the Philippines lack access to computers and other technologies such as cellular phones, and that Philippines has under 70% mobile phone penetration in relation to its population, which explains that some isolated and relatively poor communities have no cellular networks (Barela *et al*., 2019). Moreover, the physical separation of students and instructors, such as modular learning and other modalities in distance

learning, needs all communication to be mediated with technology (Yilmaz, 2017).

Furthermore, access to appropriate technology and internet connection plays a crucial role. Seemingly, modular learning alone may not be sufficient in teaching laboratory subjects and needs to be supplemented with activities requiring appropriate technology to attain the learning outcomes. The barrier exists on this aspect which makes FLM implementation becomes a challenging experience. The findings of this study confirmed the report in Mayol (2020) that strong internet access is a significant problem in the delivery of instruction during the pandemic since not everybody can afford to buy and secure a stable internet connection. Moreover, the result also justified the report of Akamai (2017 as cited in Tria, 2020) that the Philippines was among the countries with low internet connectivity. In addition, the result strengthens the claim in De Villa and Manalo (2020), which identified the digital divide or access to technology as one of the challenges in implementing distance learning. This challenge involves the financial constraints experienced by learners since mobile phones, laptops, desktops, and other devices requiring certain specifications for learning are costly. The result supports the argument in Tria (2020) that implementing the distance learning modalities poses a problem for poor students who have no gadgets and have limited access to the internet. However, the result contradicts Barrera, Jaminal, and Arcilla (2020), which claimed that most students have access to gadgets and internet connectivity. High level of teaching-learning process aims in (a) developing experimental, design, problem-solving and analysis skills; (b) developing data-recording and analysis skills; (c) familiarizing students with equipment techniques and materials; (d) developing practical skills; (e) developing communication and interpersonal skills; (f) developing technical judgement and professional practice; (g) integrating theory and practice; (h) motivating students. Even though online delivery of practical components may be carefully designed to achieve most of these aims, (c) and (d) may be difficult to achieve through the online mode.

Students-Readiness Related Challenges

The study's findings suggest that the participants believed that students were unprepared to engage in independent learning through FLM since they rely on teachers' intervention during face-to-face class. The paradigm shifts in education as the COVID-19 pandemic strikes forced educational institutions to shift into flexible learning. With the abrupt changes, students seem to have no option but to dwell on the offered modalities. Additionally, most schools did not properly address learner preparedness with the abrupt implementation of FLM.

The result contradicted Barrera, Jaminal, and Arcilla (2020), which claimed that students are ready for flexible learning. Moreover, Baticulon *et al.* (2020) supported the result, who identified individual barriers in learning during a pandemic such as a difficulty adjusting learning styles, mental health difficulties, physical health issues, and practical concerns. Additionally, Baticulon *et al.* (2020) also identified technological barriers such as lack of devices or limited access due to gadget sharing, unreliable, slow, or no internet access, lack of technical skills, and issues with the online learning platform. Furthermore, according to Parkes, Stein, and Reading (2015), students were unprepared for a range of e-learning competencies, particularly in some aspects such as time management, critical thinking skills, and collaborating with others.

With FLM, students seemed to delay submissions of outputs banking on the premise of flexible learning. Moreover, the findings suggest that some students lack technical competence in using technology such as google classroom for submission of outputs, which contributes to the delay. The result was consistent in Dangle & Sumaoang (2020), which stressed that submitting works was often late, and most learning activities were returned unanswered. However, the result provided insights on the importance of setting clear guidelines and means of submission within the students' capacity and capability.

Another essential insight uncovered in the result is the crucial role of giving instructions and the

difficulty level of learning activities in the learning modules. Students seem to have issues understanding and following instructions, and the learning activities were complex and seemed to be too difficult for them since they will be working alone. These can link to their lack of readiness in FLM, as it engages them independently with lesser teachers' intervention. The result supported the report in Perez (2020) that learners, especially in a remote area, cannot read and comprehend independently. Hence, modular learning may not work in some places in the country. The result supports Dangle and Sumaoang (2020), who pointed out that learners cannot study independently and cannot follow instructions in the learning module. In addition, the findings also confirm De Villa and Manalo (2020) that the complexity of assessment is among the challenges experienced by teachers in distance learning. Furthermore, the result supported Dangle & Sumaoang (2020), who also found out that 90% of the participants in their study are having a hard time answering their modules. Moreover, the result highlights the importance of providing clear instructions and designing learning activities based on students' level of understanding, capacity, and capability.

Teaching-Learning Process Related Challenges

The findings confirmed Mayol (2020), which pointed out that the preparation of the lesson that is different from their usual practice are among the challenges of the teachers in teaching amidst the pandemic. In terms of readiness, teachers are not an excuse in implementing the MLM since they are the ones who are preparing the learning modules. However, the limited amount of time for preparing the learning materials has brought concern for its implementation. The result suggests that preparedness for instructions in teaching laboratory subjects, considering the teacher and the learning modules, was not entirely in place. Furthermore, De Villa and Manalo (2020) also affirmed that teachers encountered a challenge in instructional delivery since they have limited skills and knowledge of ICT. Similarly, Inan (2021) also confirmed that educators have technical and educational difficulties in conducting distance learning.

Assessment and providing feedback are an integral part of the teaching-learning process. With FLM, this seems to be very challenging since the teachers cannot personally witness students' performance in various laboratory activities. In teaching laboratory subjects, assessment is mostly performance-based, requiring students to demonstrate and perform skills to support learning outcomes. Alternatively, since there are no face-to-face classes, other teachers require students' pictures or videos to prove their performance. However, limitations among students in terms of access to technologies exist; thus, output submission may be delayed or non-submission at all, which may result in non-compliance. Jeong and So (2020) supported the findings, which found out that although students could submit recorded video performance evaluations in the form of videos and written assignments, it is very time-consuming. The findings were also consistent in Estrada (2021) that there is limited or no feedback in Modular Learning. It becomes an endless stream of paperwork for teachers and students, and less attention is given to its effectiveness. In addition, Dangle and Sumaoang (2020) also reported that the bulk of paper works, and papers to check and record add up to the challenges encountered by teachers in the new normal.

Another challenge encountered by teachers related to assessment is the validity of the written outputs of students. Technology nowadays offers easy access among students to various information from the internet, which they can use to accomplish their tasks. Yilmaz (2017) supported the findings of this study which also found out that the cheating problem remains the main problem faced in online exams. Similar problems also occur in the assignment and project in which students copied and pasted things they found on the internet or copied one another's work. Additionally, Dangle and Sumaoang (2020) also affirmed that some teachers are reluctant to the learner's answers in terms of their validity. Nevertheless, the validity of outputs ensured the quality of students' learning as it allows them to write their outputs utilizing high-order-thinking skills as it operates while conceptualizing their written works.

Proposed Intervention Plan

Based on the result of the study, we can develop an intervention plan. Designing a proposed intervention plan was the ultimate goal of this study to improve the teaching process despite the present situation. Integrating the findings of this study, the areas of concerns to be addressed upon in this intervention plan are as follows: difficulty in communication, lack of access to the internet and limited access to technology, lack of student's readiness, late submission of outputs, difficulty in followings instructions, the difficulty of some learning activities, lack of preparedness for instruction, difficulty in assessing and providing feedback, and difficulty in establishing the validity of written output. The proposed intervention plan aims to: (1) identify appropriate interventions to address the different challenges encountered by teachers in teaching laboratory subjects in times of COVID-19 pandemic; and (2) implement various interventions that address different challenges in the implementation of modular learning modality in laboratory subjects. In addressing the identified challenges, appropriate interventions should be identified and implemented specifically for the context of the university implementing.

Guidelines for the implementation of Flexible Learning should be in placed to address communication-related difficulties. Specific guidelines for Teacher-initiated-phone calls and Students-Initiated-Phone calls should be reinforced. Orientation should also be conducted to students, including parents and other stakeholders, on the importance of access to communication among students, emphasizing its vital role in FLM. Furthermore, to ensure that contact information of students provided upon enrolment is functional. To address the lack of access to technology and internet connectivity, a mechanism that enables students to access internet connectivity should be put in place through the collaboration of the school management and personnel, parents, and other stakeholders to provide necessary assistance to students. Careful planning considering the limitations of some students to access technology and internet connectivity should be considered in designing the learning modules; as much as possible, the learning modules should be created based on the capacity and capability of students. Additionally, school management and teachers may coordinate with Barangay Local Government Units to establish communication lines and internet connectivity, especially to students from isolated communities, and encourage local officials to allow students to use available resources in their respective locality.

Furthermore, to address the lack of students' readiness for independent learning, school personnel should conduct an orientation to ensure students' readiness on various aspects of the teaching-learning process. The school should also assess students' readiness should be carried out to guide the university in formulating policies and designing learning resources that match with students' capacity and capability. Moreover, to address the late submission of outputs, the importance of the submission of works should be clearly emphasized during class orientation. Students should be informed regarding the purpose of the submission, which is part of the formative assessment. Orientation may be conducted utilizing pre-recorded video presentations or other means and made available and accessible to students. In addition, students should be equipped with the technical competence in using technology for submission and be informed of other means of compliance. The university should also reinforce the guidelines on the distribution and collection of learning resources. The difficulty in following instructions among students and the difficulty of some learning activities can be addressed by having clear guidelines for developing learning modules. Guidelines in designing appropriate activities and giving instructions in different learning activities should be established and integrated as criteria for evaluating the learning material.

Lack of preparedness for instruction can be addressed by careful planning in developing learning modules, and strict monitoring should be done to ensure that the materials are available at the start of classes. This also entails management strategies to motivate the teachers to pursue the development of modules for all

learners. Furthermore, equipping teachers' competence through capacity-building activities should be done, considering a holistic approach to prepare them, physically, mentally, and emotionally to engage in new teaching modalities and provide the necessary technical assistance and support. To address the difficulty in assessing and providing feedback, guidelines on assessment and feedbacking should be in place with stakeholders' consultation, especially with the parents, LGUs, and other agencies, to ensure students' and teachers' safety. Lastly, to address the difficulty in establishing the validity of written outputs, guidelines in ensuring academic honesty in all learning activities should be reinforced and appropriately implemented.

Conclusion and recommendations

The participants' narrative accounts provided insights and identified challenges from the multiple facets of their experience with the phenomenon. The exploration revealed three themes that emerged: technology and laboratory-related challenges, students-readiness-related challenges, and teaching-learning process-related challenges.

The study provided evidence that, indeed, Flexible Learning Modality used in teaching Laboratory subjects when face-to-face interaction between students and teachers was prohibited was a challenging experienced. Challenges concerning various aspects of the teaching-learning process were experienced by the participants, which should be appropriately addressed as it may affect students' learning experiences and the attainment of learning outcomes.

The teaching experience of the participants amidst the COVID-19 pandemic, specifically in laboratory subjects, marks a significant milestone in terms of pedagogy in science as it revealed various limitations and difficulties of Flexible Learning Modality, concerning availability and access to technology and communication, the readiness of students and teachers, and the preparedness of learning resources. Furthermore, we can conclude that implementing the Modular Learning Modality in teaching laboratory subjects in the LNU context does not work smoothly and efficiently enough with the identified challenges that mark the avenues that need improvement. Thus, an intervention plan was proposed and should be implemented to address them appropriately.

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