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Forensic Chemistry Laboratory Works from Home: Challenges Encountered by Criminology Students During the Conduct of their Laboratory Activities at Home

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ABSTRACT

This study aimed to determine the challenges encountered by the respondents in performing Forensic Chemistry and Toxicology Laboratory Works at home particularly on the activities about Fingerprints, Drugs , Fire and hair and determine the coping strategies utilized by the students to overcome those challenges. This study utilized a survey research design and was conducted in Sablayan, Occidental Mindoro. The respondents of the study were the 67 Criminology students enrolled in Forensic Chemistry in 2021 who experienced conducting laboratory activities in the said subject at home. The common challenges encountered by the respondents among the four (4) laboratory works conducted at home were lack of materials or equipment available; difficulty of collecting samples; and limited lessons and discussion about the topic in the module. The usual strategy used by the respondents to cope with the common challenges encountered were approached relatives to get samples or materials required for the activity and utilized internet as resources to supplement limited lessons and discussion about the topic in the module.

Keyword - Forensic Chemistry, Laboratory Activities, Works from Home, Challenges, Chemistry

INTRODUCTION

Usually, laboratory classes include experiments that supplement the lecture and discussion portions of science courses. Laboratory activities have important role in the chemistry curriculum as a means of making sense of the natural world. The laboratory environment allows students to gain a first-hand experience with course concepts and further provides them with the opportunity to explore methods used by scientists in their discipline. Laboratory **activity is a form of authentic learning** that allows students to apply theoretical knowledge to real-world situations. This pedagogy is often used by instructors in college particularly research instructors (Mendoza & Mendoza, 2021). In New York City, United States of America, the COVID-19 pandemic required educational institutions to shift to a remote or distance learning mode. Classes were offered online, and this causes teaching modality presented great challenges, especially in teaching laboratory courses. Several options were utilized in teaching laboratory classes such as videos of lab demonstrations, Microsoft PowerPoint slides with voice-over recordings which guide students further in the particular procedure of the experiment, and kitchen-based experiments that students could perform at home in asynchronous modality (Mojica & Upmacis, 2021). Studies conducted during the COVID-19 pandemic, revealed that students considered that the main role of a teaching laboratory is to provide hands-on experience and that, overall, the online modalities do not compare favorably to the traditional in-person laboratory approach (Petillion & McNeil, 2021). It has also been found that students in a virtual environment struggle to meet skill-based objectives and comprehend how to use equipment (Hensen, Glinowiecka-Cox, & Barbera, 2020) commonly used in Forensic Chemistry such as Microplasma-Atomic Emission Spectroscopy (Mendoza et al., 2019), Gas Chromatography–Mass Spectrometry, Fourier Transform Infrared Spectrometer (FTIR) and others.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue X October 2025

In the Philippines, to respond to the needs of learners, especially of the tertiary-level students enrolled in Higher Education Institutions, the country have implemented proactive strategies for the continuance of education despite the pandemic. These include the modified forms of online learning that aim to aid student learning activities. Online learning could be of synchronous, real-time lectures and time-based outcomes assessments, or asynchronous, delayed-time activities, like pre-recorded video lectures and time-independent assessments (Joaquin, Biana, & Dacela, 2020). Ateneans or the Ateneo De Manila students have been taught online. However, the transition to a online environment presented challenges for science education and training (At Home, But Still Doing Lab Work. 2021).

In Occidental Mindoro State College, blended learning or the combination of online and modular classes was utilized. However, due to poor internet connection in most areas in Sablayan, Occidental Mindoro, the College of Criminal Justice Education of OMSC Sablayan, opt to use modules as mode of distance learning. Modules were printed and distributed to students and was retrieved on scheduled date.

With this context, the researchers were motivated to conduct a study on the challenges encountered by the BS Criminology Students when they perform laboratory activities at home instead on the real laboratory environment.

The results of this study will be significant to OMSC for it will serve as a basis to improve its existing program and guidelines on the delivery of modular instruction particularly if the subject has a laboratory. Likewise, this enables the faculty with laboratory subject to adjust their teaching strategies to enhance modular distance learning. Moreover, the output of this study will be beneficial to the students in a way that this will serve as a venue to express the challenges they faced in conducting laboratory works at home where in there is lack of resources available.

Objectives

1. Identify the profile of the respondents in terms of age and sex .

2. Determine the challenges encountered by the respondents in performing Forensic Chemistry and Toxicology Laboratory Works at home particularly on the following activities:

    a. Laboratory Work 1- Fingerprints

    b. Laboratory Work 2 – Drugs

    c. Laboratory Work 3- Fire

    d. Laboratory Work 4 – Hair

3. Determine the coping strategies utilized by the respondents to overcome the encountered challenges.

MATERIALS AND METHOD

This study utilized a survey research design and was conducted in Sablayan, Occidental Mindoro. The respondents of the study were the 67 Criminology students enrolled in Forensic Chemistry in 2021 who experienced conducting laboratory activities in the said subject at home. The researchers used a survey questionnaire as research instrument. The instrument was validated by experts. There were three parts of the questionnaire, first was about the profile of the respondents. The second and third part focused on the challenges encountered by the respondents in performing Forensic Chemistry and Toxicology Laboratory works at home and the strategies utilized by the students to overcome such challenges respectively. The researchers requested permission from the program head of BS Criminology Department of OMSC Sablayan as well as from the respondents prior to the conduct of the study. Through the google form, the survey was done. The link of the questionnaire was sent to the facebook messenger account of the respondents. When all the respondents were done answering the questionnaire , the researchers analyzed the data . Frequency and percentage were employed to identify the profile of respondents, determining the challenges encountered by the respondents in performing

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue X October 2025

Forensic Chemistry and Toxicology Laboratory works at home and the strategies utilized by the respondents to overcome the encountered challenges.

RESULTS

Table 1 shows the profile of the respondents in terms of age and sex. Most of the students were 21 years old (49. 25%) . They were adults who could already perform simple laboratory works at home during the pandemic. The respondents distribution in terms of sex were almost equal however, male sex had higher percentage which was 34 or 50.7%. This means that both male and female could survive in BS Criminology course and subjects like Forensic Chemistry.

Table 1. Profile of the respondents in terms of age and sex.

Profile of the respondents	Frequency n=67	Percentage
Age		
31	1	1.49
28	1	1.49
26	1	1.49
23	4	5.97
22	10	14.92
21	33	49.25
20	17	25.37
Sex		
Female	33	49.3
Male	34	50.7

Challenges encountered by the respondents in performing Forensic Chemistry and Toxicology Laboratory works at home.

Table 2 shows the challenges encountered by the respondents in performing Forensic Chemistry and Toxicology Laboratory works at home. In terms of the activity about fingerprint, the students were instructed to collect thumb marks of both sexes of a child, teenager, an adult and a senior citizen and compare the different sizes and looks of a thumbprint of a typical person in its age. Most students experienced difficulty in collecting fingerprint samples from persons. (28.35%) and some fingerprints were not visible (26.87%). Also, some of them lacked of available materials at home such as ink and ink pad (13.43%).

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue X October 2025

Table 2. Challenges encountered by the respondents in performing Forensic Chemistry and Toxicology Laboratory works at home.

Challenges	Frequency mentioned n = 67	Percentage
Fingerprints		
1.Difficulty in collecting fingerprint samples from persons.	19	28.35
2.Some fingerprints were not visible.	18	26.87
3.Lack of available materials at home such as ink and ink pad.	9	13.43
4.Limited module lesson	9	13.43
5.Deficiency of knowledge to conduct fingerprinting activity	7	10.45
6. Hard to identify the difference of each fingerprints whether the thumb mark is from male or female.	6	8.96
7.Working table and answer sheets becomes messy with ink	3	4.48
8.Hard to understand when no one is teaching	2	2.99
9.Unstable internet connection at home.	1	1.49
10.Time management.	1	1.49
Drugs		
1.Unclear lesson and limited module lessons.	23	34.33
2.Confusion in classifying drugs according to origin, legal classification and pharmacological effects .	11	16.42
3.Limited knowledge or familiarity about the topic (some chemicals were not familiar to me).	11	16.42
4.No materials or drugs available at home.	9	13.43
5.It's hard to choose which drugs to pick for the activity.	2	2.99
6.No internet connection to be used to supplement my knowledge about drugs.	2	2.99
8.Due to confusion, answer sheets were dirty of lots of erasures	1	1.49
Fire		
1.It's hard to determine the exact color manifested by the fire.	24	35.82
2.Limited discussion and explanation of lessons in the module .	16	23.88

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue X October 2025

3.Finding materials and equipment at home.	11	16.42
4.Implementing safety measures to be observed during the conduct of activity.	7	10.45
5. Limited knowledge about the topic.	4	5.97
6.Getting burns	3	4.48
7.I don't know which materials to be burned to get the required color in the activity.	3	4.48
8.Bad smell of burned materials	3	4.48
9. Place at home to conduct the activity.	2	2.99
10.Some materials I tried did not match the color of the fire required in the activity.	1	1.49
Hair		
1.Difficulty in collecting hair samples from dog or cat.	42	62.69
2. Limited discussion of the topic in the module.	18	26.87
3. Hard to differentiate human, dogs and cats hair.	17	25.37
4. No equipment to be used in identifying hair samples at home.	3	4.48
5. Difficulty finding sources on the internet.	1	1.49

The second laboratory work was regarding drug. The students listed five common house hold medicines and classify them according origin, legal classification and pharmacological effects. According to most of the students, the lesson was not clear and there were limited module lessons about drugs (34.33%). The second problem was confusion in classifying drugs according to origin, legal classification and pharmacological effects were experienced by students (16.42%) this could be because of the limited module lesson. They also mentioned that they have limited knowledge or familiarity about the topic (16.42%). In addition, there was no materials or drugs available at home (13.43%) .

For the laboratory activity about fire, the students were instructed to observe the different colors of fire and document what material is giving away that kind of flame. According to them, it's hard to determine the exact color manifested by the fire (35.82%). There was also limited discussion and explanation of lessons in the module (23.88 %) and they had difficulty in finding materials and equipment needed for activity at home (16.42%).

In terms of activity about hair, the students collected human hair, dog hair and cat hair, described and differentiated them with each other using a Venn diagram. During this activity, the respondents had difficulty in collecting hair samples from dog or cat (62.69%) this could be because dogs and cats would bite them . They also mentioned that there was limited discussion of the topic in the module (26.87 %). Furthermore, for them, it was hard to differentiate human, dogs and cats hair (25.37%).

Coping strategies utilized by the respondents to overcome the encountered challenges

To overcome challenges encountered in performing Forensic laboratory works at home, the students utilized some strategies. These strategies were shown in Table 3.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue X October 2025

In Laboratory Work 1- Fingerprints, those respondents who met difficulty in collecting fingerprint samples from persons briefly explained to the prospected fingerprint sample owners the purpose of collecting fingerprint for the activity to get rid of their hesitation and worries. They also entertained the children participants before collecting their thumb marks and gave them token afterwards (25.37%). When some fingerprints were not visible, the respondents did more trials for fingerprint collection per person (10.45%). They also used the ink from pen or marker when there was no ink and ink pad available at home (22.39 %).

Table 3. Coping strategies utilized by the respondents to overcome the encountered challenges.

Challenges	Coping strategies	Frequency mentioned n = 67	Percentage
Fingerprints			
1.Difficulty in collecting fingerprint samples from persons.	1. Briefly explained to the prospected fingerprint sample owners the purpose of collecting fingerprint for the activity to get rid of their hesitation and worries. Entertained the children participants before collecting their thumb marks and and gave them token afterwards.	17	25.37
	2.Whenever I went out, I brought my activity sheets with me and collected fingerprints.	2	2.99
	3.Approached relatives to get fingerprint samples.	1	1.49
2.Some fingerprints were not visible.	1. Did more trials for fingerprint collection per person.	7	10.45
	2.Find person with good fingers condition or no skin disease.	4	5.97
3.Lack of available materials at home such as ink and ink pad.	1.Used the ink from pen or marker when there was no ink and ink pad available at home.	15	22.39
	2. Search on the internet which materials can be a substitute for ink pad.	2	2.99
	3.Borrow ink pad.	2	2.99
4.Limited module lesson	1.Used the internet to supplement knowledge about the topic.	14	20.90
5.Deficiency of knowledge to conduct fingerprinting activity	1.Used the internet to supplement knowledge about the topic.	14	20.90

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue X October 2025

6. Hard to identify the difference of each fingerprints whether the thumb mark is from male or female.	1.Used the internet to supplement knowledge about the topic.	14	20.90
7.Working table and answer sheets becomes messy with ink	1.Got another sheets for replace messy answer sheets.	3	4.48
8.Hard to understand when no one is teaching	1.Used the internet to supplement knowledge about the topic.	14	20.90
9.Unstable internet connection at home.	No answer	0	0
10.Time management.	No answer	0	0
Drugs			
1.Unclear lesson and limited module lessons.	1. Used the internet to supplement learning about the activity.	20	29.85
2.Confusion in classifying drugs according to origin, legal classification and pharmacological effects .	1. Review the lesson and tried to answer the questions in the activity.	6	8.96
	2. Ask other people and relatives about the classification of drugs at home.	6	8.96
	3. Sought help from medical professional accomplish the activity.	1	1.49
3.Limited knowledge or familiarity about the topic.	1. Used the internet to supplement learning about the activity.	20	29.85
4.No materials or drugs available at home.	1. Just keep finding drugs inside the house until it become a general cleaning.	4	5.97
	2. Brought medicine from nearby store	2	2.99
5.It’s hard to choose which drugs to pick for the activity.	1. Used the internet to supplement learning about the activity.	20	29.85

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue X October 2025

6.No internet connection to be used to supplement my knowledge about drugs.	No answer		
8.Due to confusion, answer sheets were dirty of lots of erasures	No answer		
Fire			
1.It's hard to determine the exact color manifested by the fire.	1. Focused and observed thoroughly while burning the materials.	6	8.96
	2.Did several trials to identify the color of fire being manifested by burning materials	3	4.48
2.Limited discussion and explanation of lessons in the module .	1. Looked for other references on internet to supplement my knowledge about the activity.	24	35.82
	2.I did self - study.	4	5.97
3.Finding materials and equipment at home.	1.I borrowed the unavailable materials from my neighbors or relatives.	3	4.48
4.Implementing safety measures to be observed during the conduct of activity.	1.Keep fire extinguisher nearby while conducting the activity.	1	1.49
5. Limited knowledge about the topic	1. Looked for other references on internet to supplement my knowledge about the activity.	24	35.82
	2.Asked ideas from classmates	4	5.97
6.Getting burns	1.Used PPE to avoid the unpleasant smell coming from the burning materials and prevent burns.	4	5.97
7.I don't know which materials to be burned to get the required color in the activity.	1. If I burned some materials in which color of fire was hard to recognized, I changed the materials.	3	4.48
8.Bad smell of burned materials	1..Used PPE to avoid the unpleasant smell coming from the burning materials and prevent burns.	4	5.97
2.Place at home to conduct the activity.	No answer.		

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue X October 2025

4.Some materials I tried did not match the color of the fire required in the activity.	1.I gathered different classes of materials which I subjected to testing first before conducting the actual activity for me to know if these materials were providing different colors of fire.	4	5.97
Hair			
1.Difficulty in collecting hair samples from dog or cat.	1.Went to the neighborhood or relatives to ask for hair of their pets dog or cats.	13	19.40
	2.Collected hair from bed of cat.	2	2.99
2. Limited discussion of the topic in the module.	1.Used internet to supplement information about hair of different species.	20	29.85
	2.Asked some person about the activity.	5	7.46
3.Hard to differentiate human, dogs and cats hair.	1.Observed wisely to differentiate the human, dog and cat hair.	3	4.48
	2.Did self-study.	1	1.49
4.No equipment to be used in identifying hair samples at home.	1.Borrowed materials from classmates.	1	1.49
	2.Separated each hair sample immediately.	1	1.49
5.Difficulty finding sources on the internet.	1.Asked some person about the activity.	5	7.46

For Laboratory Work 2 – Drugs , those who found that the lesson was not clear and there were limited module lessons about drugs and students who had limited knowledge or familiarity about the topic used the internet to supplement learning about the activity (29.85%). To avoid confusion in classifying drugs according to origin, legal classification and pharmacological effects, the students reviewed the lessons about drugs and tried to answer the questions in the activity (8.96%). They also asked other people and relatives about the classification of drugs found at home (8.96%).

In the laboratory activity about fire, respondents who hardly determine the exact color manifested by the fire, focused and observed thoroughly while burning the materials (8.96%). Moreover, they did several trials to identify the color of fire being manifested by burning materials (4.48%). Since there was limited discussion and explanation of lessons in the module, they looked for other references on internet to supplement their knowledge about the activity (35.82%). Some students borrowed the unavailable materials needed for the activity from their neighbors or relatives (4.48%).

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue X October 2025

During this activity on hair , the respondents who had difficulty in collecting hair samples from dog or cat because those animals would bite them went to the neighborhood or relatives to ask for hair of their pet dogs or cats (19.40%). Also, they tamed the dogs by feeding in order to get hair samples from them (13.43%) . For the limited discussion of the topic in the module, the students used internet to supplement information about hair of different species (29.85 %) . Respondents who hardly differentiate human, dogs and cats hair , observed wisely to differentiate the human, dog and cat hair. (4.48%).

DISCUSSION

The common challenges encountered by the respondents among the four (4) laboratory works conducted at home were lack of materials or equipment available; difficulty of collecting samples; and limited lessons and discussion about the topic in the module. This was similar to the findings of Mojica and Upmacis (2022) that one of the challenges encountered by the Students in a General Chemistry Laboratory Course During the COVID-19 Pandemic was unavailability of the required materials. This was because New York City then was an early epicenter of the pandemic and it is understandable that students were scared to go out of their homes to buy materials. These challenges mean that respondents may have struggled to learn completely the principle behind each experiment (Mojica &Upmacis, 2022).

The usual strategy used by the respondents to cope with the common challenges encountered were approached relatives to get samples or materials required for the activity and utilized internet as resources to supplement limited lessons and discussion about the topic in the module. These imply that technology or utilizing internet played a big role in conducting laboratory works at home (Gamage, et al. 2020).

CONCLUSIONS

The respondents of the study were young adults and the ratio between male and female was almost the equal. The common challenges encountered by the respondents among the four (4) laboratory works conducted at home were lack of materials or equipment available; difficulty of collecting samples; and limited lessons and discussion about the topic in the module. The usual strategy used by the respondents to cope with the common challenges encountered were approached relatives to get samples or materials required for the activity and utilized internet as resources to supplement limited lessons and discussion about the topic in the module.

RECOMMENDATIONS

Based on the findings of the study, it is recommended that higher education institutions offering Criminology programs strengthen the delivery of Forensic Chemistry laboratory courses through the integration of virtual simulations, video demonstrations, and interactive online laboratory tools. These can help bridge the gap between theoretical understanding and practical application when face-to-face sessions are not possible.

Faculty members may also undergo training on innovative teaching strategies and digital tools suited for remote laboratory instruction to ensure that learning outcomes are effectively met. Furthermore, institutions may consider providing students with access to laboratory kits or safe, affordable alternatives that can be used at home for basic experiments and skill development.

This study recommended that future researchers explore comparative studies between online and in-person laboratory modalities to determine best practices that can enhance students' competencies and engagement in forensic science education.

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