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IMPLEMENTATION OF FORENSIC BALLISTICS LABORATORY ACTIVITIES AND STUDENTS' PERFORMANCE: INPUTS FOR AN ENHANCED INSTRUCTIONAL DELIVERY

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Abstract

This descriptive-correlational study assessed the impact of forensic ballistics laboratory activities on the instructional delivery for criminology students. The study involved 102 graduating students from Kapalong College of Agriculture, Sciences, and Technology (KCAST) in Davao del Norte and Kolehiyo ng Pantukan (KNP) in Davao de Oro, both located in Region XI. The laboratory activities included firearm identification, firearm comparison, fired bullets examination, and projectile examination, all of which are crucial components of forensic ballistics. The results showed that the implementation of these activities positively affected the students' understanding and performance in forensic ballistics. Based on these findings, several recommendations were proposed to enhance instructional delivery. The study suggests incorporating more crime laboratory activities and using a variety of laboratory tools and chemicals for a comprehensive understanding. It also recommends grading these activities separately to provide a clearer assessment of student performance. The study highlights the need for instructional materials focused on measuring bore diameter and the use of magnification tools to assess firearm characteristics more effectively. In examining cartridge cases, the study suggests using instructional materials that provide basic knowledge and incorporating activities that focus on marks produced by the firearm. Additionally, the use of a comparison microscope is recommended to enhance accuracy. The examination of projectiles, the study recommends using a micrometer for precise measurements and comparing test bullets with standard ones to improve students' skills in forensic ballistics. These recommendations aim to improve the overall instructional delivery in forensic ballistics education.

Keywords: *crime laboratory, criminalistics, forensic ballistics, firearm examination, and assessment*

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INTRODUCTION

Colleges and universities have opted to innovate to provide criminology students with the skills and knowledge necessary to work in crime detection, investigation, and criminalistics as forensic ballistics specialists. Thus, institutions are mandated by the Commission on Higher Education (CHED) to produce graduates who possess knowledge, skills, attitudes, and values that can respond to the problem of criminality, as well as the character and competence necessary to deal with it under Memorandum Order No. 5, Series of 2018. Criminalistics is one of the subjects of the criminology students and part of its practical exercises should be done in a crime laboratory as a specialized facility to conduct an examination and analysis of a particular thing collected in a crime scene to be used as evidence in any crime incident. The piece of evidence collected from the crime scene is the primary focus of examination and analysis by the laboratory specialist in forensic science necessary to determine the causes, suspects, and victims of a crime. The study of forensic ballistics includes the evidence collected from the crime scene and the examination performed in the crime laboratory. When a firearm was found in the crime scene, its investigation with the specialization of forensic science will focus on the examination of firearms, examining the direction of a bullet from where it was discharged until its impact on the target. While the investigation process is ongoing, in which firearms are suspected to have been used, need to be assessed including all other associated implements and materials like bullets, live ammunition, cartridge cases, trace materials, and any material affected by the projectile, Jackson (2021).

Kreikemeier (2019) explains the main purpose of the study in forensic ballistics is to investigate and identify firearms and ammunition fired through them. One of two types of forensic ballistics examinations guides the laboratory instructor. At first, the field investigation involves investigating on the ground in which firearms evidence was collected, marked, preserved, packed, and transmitted. The bullets and firearms are studied thereafter according to their class characteristics. In the conduct of laboratory activity for the students of the forensic ballistics course, the main objectives for their activities are to examine the collected evidence involving firearms, fired bullets/cartridge cases, pellets, wads, bullet fragments, cartridge components, and related specimens; conduct test firing of firearms, its bullets and cartridge cases for comparison with the evidence bullets and cartridge cases; and conducts scene of the crime operations and field laboratory works, and the equipment utilizes per activity such as the bullet interceptor, table for remote firing of weapons, gas ammunition firing chamber, research ballistics tubs, and bullet recovery box. Akasha (2020) describes the procedures of Firearm Identification as the process of subjecting the bullets and cartridge cases left at a crime scene to examination to determine or identify what firearm they were discharged from. For this to be achieved, there has to be an examination and comparison of fired bullets and fired cartridges at the microscopic level to allow the expert to determine all the relevant facts and information. All firearm evidence must be collected especially where a crime was committed. As a consequence, the scene investigation has examined it to collect the fired bullets and cartridge cases. In addition to those processes, they must look for anything else containing gunpowder or other residues that serve as evidence. Crime scene investigators will then meticulously prepare a careful record of those involved in handling or transporting evidence to the forensic laboratory in where the firearm identification process takes place.

The microscopic comparison of fired bullets and cartridge cases allows forensic experts to determine if a particular firearm was used. Even without a suspect firearm, investigators can identify a list of potential firearms that may have discharged a bullet or cartridge case. When a gun is fired, unique characteristics of the firearm are transferred onto the bullet and cartridge case, a principle backed by physical sciences like physics, metallurgy, and materials science.

Once firearm evidence reaches the lab, the examiner's job begins with several steps. Trace evidence may first be removed from the bullet or cartridge for other analyses, followed by an assessment of the class characteristics. These distinct features of each firearm are imprinted on the evidence. According to CSI Net (2021), it is crucial for firearm examiners to take detailed notes throughout the process, especially if the evidence is used in court, where the examiner may have to testify about the process. Firearm evidence is

commonly found in violent crimes such as homicide, robbery, and assault, and it may also be linked to narcotics cases. Bullet and cartridge case comparisons are frequent, but other examinations are also essential, such as determining firing distance based on gunshot residue, examining firearm modifications, tracing ownership, or restoring serial numbers. Gunshot residue on a person's hands or body can also reveal evidence of firearm discharge or handling.

Firearm analysis relies on comparing fired bullets and cartridge cases. Rifling, or the spiral grooves inside the barrels of handguns and rifles, leaves distinct marks on bullets when fired. These rifling characteristics—such as the width, number of grooves, and the direction of the twist—are unique to specific firearms. These marks allow firearm examiners to determine the type of weapon that fired the bullet. Each firearm's barrel has imperfections from the manufacturing process, leaving unique marks that help match bullets to specific firearms. As explained by CSI Net (2021), when a firearm is tested, it is fired into a water tank in the lab. The test bullet is then compared under a microscope to the bullet recovered from the crime scene. Cartridge casings also bear unique marks—such as firing pin impressions, breech face marks, and extractor marks—that can be matched to a suspect's firearm.

In firearms cases, evidence can range from small bullet fragments to hundreds of bullets or cartridge cases, yet even small samples can help investigators identify the firearm used. Wads and pellets can also be found at crime scenes and are analyzed similarly to bullets to determine the firearm's gauge. Gunshot residues, which fall into two categories, are another key form of evidence: residues collected from a suspect's hands can indicate recent firearm use, while residues on a victim's clothing can help determine firing distance. Microscopic and chemical tests are required for this analysis, as gunshot residues are not visible to the naked eye.

The Simplified Firearm Organization (2021) explains that firearm evidence is collected in various ways, depending on the scene and laboratory protocols. Firearms themselves are typically sent directly to the lab, while bullets, fragments, and casings are first documented. In cases where bullets are retrieved during autopsies, they are treated as biohazards before being sent to the lab. When bullets are embedded in surfaces like wood or concrete, a section of the material is often cut out for careful extraction to preserve evidence. Evidence submission follows strict chain-of-custody protocols, and labs must be equipped with specific tools such as measuring devices, stereo microscopes, and comparison microscopes for analyzing fired bullets and cartridges. Test-firing facilities, such as water tanks used to recover bullets, are also essential. Additional tools used in the examination process include calipers, micrometers, engravers, and cleaning solutions, along with personal protective equipment.The procedure fired projectile examination Item preparation; Projectiles might be contaminated with biohazardous material. If this were to happen, it has to be cleaned with a soft-bristle brush and a disinfectant such as Terg-A-Zyme, Hibiclens, and/or ethanol. Cotton-tipped swabs saturated with acetone or ethanol may be used to clean projectiles. Lastly, mark all evidence of bullets or projectiles for examination. It has been exposed to many rudiments of criminalistic activities in the crime laboratory of a school. One of the several realities is that criminology graduating students should be knowledgeable about their criminalistics skills upon graduation. Consequently, advocating the improvement of the crime laboratory of every school institution with a criminology program where their student must be given hands-on activities for their criminalistics courses are visions and directives as noted by CHED Memo Series (2018). Thus, the researcher believes that a careful look or scrutiny should be given to the existing utilization of the school crime laboratory in the local colleges of Region XI, in the hope of streaming these procedures to come up with our criminology graduate for advanced knowledge in criminalistics or forensic science in the investigation and detection of crimes, particularly for a forensic ballistics' examination.

This study is anchored on the principle of Dr. Edmond Locard, a pioneer in forensic science, terminals leave traces of their crimes behind them. Thus, August Vollmer the California Police Chief established the need to establish a reliable way of analyzing clues from a crime scene by conducting forensic examinations of the crime scene material to determine the responsible party that study focuses on forensic ballistics activities in the crime laboratory, the identification of firearms, comparison of firearms, cartridge cases, fired shot shells,

and projectile examination. As to further understanding, some terminologies are elaborated like Firearm Identification as the process of analyzing the bullets and cartridge cases left at a crime scene to determine if they came from a particular firearm. It is a sub-category of tool mark identification; which has as its primary concern to determine if a bullet, cartridge case, or other ammunition component was fired by a particular firearm, afte.org (2021); Comparison of Firearms as an examination of two or more firearms to establish similarities and dissimilarities, and it also focuses on the examination of firearms and related subjects. This is related to ballistics which focuses on the bullet projectiles with the practice of forensic science during the investigation of firearms particularly examining the path of a bullet from when it leaves the firearm until it hits the target. During investigations in which the use of firearms is suspected, several are artifacts collected for examination, including firearms, cartridge cases, bullets, live ammunition, trace materials, and any material damaged by a projectile (2021); Cartridge Cases as the envelope (container) of a cartridge. As described by the Weapons Law Encyclopedia for rifles and handguns, it is usually a metal cylindrical tube, made of brass or steel, holding the bullet at the neck, the propellant is charged inside, and the primer in its base. The groove and rim can be found at the outer circumference of the base of the cartridge case, to assist in extraction upon firing. The case for shotguns is usually made of paper or plastic with a metal head often called a shell. Caseless ammunition does not have a metal case to contain the propellant, weaponslaw.org (2021); Fired Bullet Examination as the rifled firearms that receive both the class and individual characteristics of the barrel from which they are fired. The bullet will show primary markings left by the gun barrel's lands and grooves and reveal the fine striations in all the marks. These are the imprints of the minor irregularities in the barrel and are never duplicated by the different firearms. ensicyard.com (2020); and Projectile Examination as a body projected by external force and continuing motion by its inertia especially a missile for a weapon. As cited by quizlet.com (2021), the projectile is any object that once projected or dropped continues in motion by its inertia and is influenced only by the downward force of gravity.

Objectives

In the conduct of crime laboratory activities particularly in determining forensic ballistics activities, the following questions need to be answered as follows:

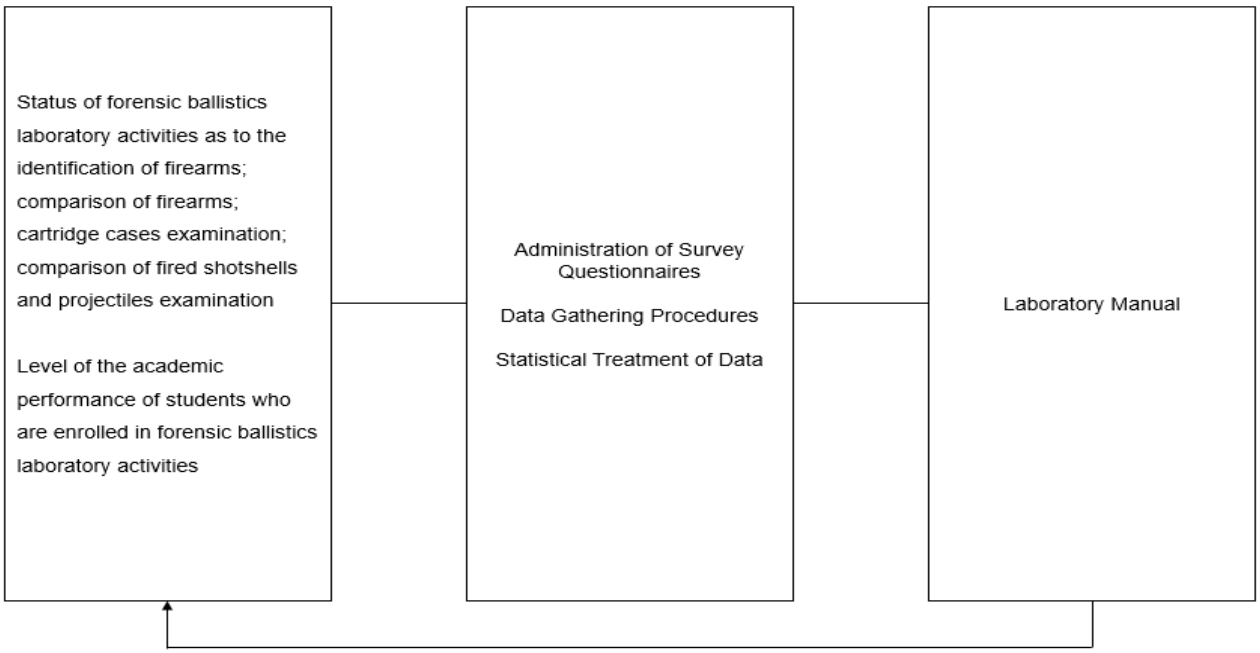
1.What is the level of the academic performance of students who are enrolled in forensic ballistics laboratory activities?

2.Is there a significant relationship between the forensic ballistics' laboratory activities of student knowledge of crime laboratory activities under forensic ballistic subjects?

Figure 1.

Research Paradigm

INPUT **PROCESS** **OUTPUT**



The ***research framework*** of this study is depicted in Figure 1 above, the students' forensic ballistics activities in the crime laboratory. Likewise, the student's performance in the forensic activities of the crime laboratory in the community colleges in Region XI. As to its implementation, the following are to be assessed by the respondents: identification of firearms, comparison of firearms, cartridge cases, fired shot shells, and projectiles examination—the impact on the implementation of forensic ballistics to be assessed by the criminology graduating students. To determine the implementation of forensic ballistics laboratory activities in local colleges in Region XI. The researcher attempted to find answers to the research questions with the end view of developing instructional materials for crime laboratory activities. Specifically, it answered the following research questions: 1) What is the status of forensic ballistics laboratory activities as to the identification of firearms, comparison of firearms, cartridge cases examination, comparison of fired shot shells, and projectiles examination?; 2) What is the level of the academic performance of students who are enrolled in forensic ballistics laboratory activities?; 3) Is there a significant relationship between the forensic ballistics laboratory activities and students' performance?; and 4) Based on the results of the study, what instructional-related materials could be developed?

Considering the research questions propounded in the foregoing research questions, the ***research hypothesis*** was presented by this researcher, as follows: There is no significant relationship between the forensic ballistics laboratory activities and academic performance among the local colleges in Region XI in the identification of firearms; comparison of firearms; cartridge cases examination; comparison of fired shot shells and projectiles examination. Thus, the study focuses on the assessment of the implementation of forensic ballistic activities in the crime laboratory of the two local colleges in Region XI, the Kapalong College of Agriculture, Sciences and Technology, and Kolehiyo ng Pantukan. The respondents sought to answer the five areas of self-made questionnaires on the implementation of forensic ballistics activities in the crime laboratory as to the identification of firearms; comparison of firearms; cartridge cases examination; comparison of fired shot shells and projectiles examination.

Therefore, this research will undoubtedly be significant to the following stakeholders: 1) ***School Administrator-*** the finding of the study would pave the way as mandated by the Commission Memorandum Order (CMO) No. 05 Series of 2018, particularly in the curriculum of criminalistics activities, in the sense that the results on the performance of the students will surely enhance their awareness; 2) ***Criminology Instructors*** the result of the study plays an important contribution to the laboratory instructor for the provision of a

clear understanding of the students in every activity particularly in teaching criminalistics courses and its laboratory activities; 3) ***Students***- the finding of this study would make them more aware of the intricacies involved in the utilization of crime laboratories. They would be able to give more effort in the utilization and conduct of activities for their criminalistics courses, and 4) ***Future Researcher***- data obtained from the study may provide them with baseline information as the basis for further investigation and future studies.

METHODS

The researcher adopted a ***descriptive-correlational research*** design. A ***research locale*** of the study was conducted among community colleges in Region XI. One of the identified institutions that provided the needed data was the Kapalong College of Agriculture, Sciences, and Technology (KCAST), a landlocked municipality in the coastal province of Davao del Norte. It is one of the three colleges in the municipality, and the only locally-run college institution with government recognition by the Commission on Higher Education for the different programs/courses in Region XI. Science laboratories and equipment were also provided as part of the compliance process. To date, KCAST has a population of 4200 students with four recognized programs, including the criminology program. Another academic institution that gave reliable data was the Kolehiyo ng Pantukan (KNP), the other local college of Region XI as part of the study where the criminology graduating students who had undergone their criminalistics courses were the focus of the study. Pantukan is described as a coastal municipality in the province of Davao de Oro. The ***research respondents*** of this study are criminology students who have already undergone their forensic ballistics in the school year 2018-2019, who were graduating students, and their assessment could be based on their practical knowledge of the activities in the forensic ballistics course.

Table 1.

Fair Distribution of the Respondents.

Community College in Region IX	Year level of Students	Number of students as respondents	Percentage %
Kapalong College of Agriculture, Sciences and Technology (KCAST)	Graduating Students	48	52.94%
Kolehiyo Ng Pantukan (KNP)	Graduating Students	54	47.06%
Total Respondents		102	100%

The study used a ***universal sampling technique*** with a limited population size expected by James Baker (2021). There was little difference between the expected sampling frequencies between the populations of the two schools whose graduating students had performed the forensic ballistics activity with 102 students, as the respondents assessed how they performed during the laboratory activity. The ***collection of data*** is an essential part of this study. Thus, in gathering data, the face-to-face conversations with respondents were necessary for the reliability of the information. The answers from the individual respondents provided factual data analysis, however, several aspects came into play in the collection process. The ***research instrument*** of the study utilized survey questionnaires as its instrument to determine the implementation of forensic ballistics laboratory activities. Moreover, the questionnaires are in a checklist form that has gone through the validation process. The process taken on by the researcher in formulation and validation of the instrument used in the gathering are enumerated: Reading of related literature and related studies as a guide in formulating the questionnaires;

Formulation of the first draft of the questionnaires; Submission of the first draft questionnaires to the adviser for checking; Validation of questionnaires through the use of test and retest; and Formulation of the final draft of the questionnaires.

In ***data gathering*** procedures, the researcher observed the following techniques: the researcher prepared a letter of consent and addressed it to the school administrator, and upon approval, the questionnaires were distributed to the respondents. The procedure on how to answer the questionnaires was explained by the researcher to the respondents. Data gathered from the respondents were tabulated, interpreted, and analyzed. In interpreting the data, the researcher used the statistical tools: formula as ***Average Weighted Mean*** used to determine the status of forensic ballistics laboratory activities as to the identification of firearms; comparison of firearms; cartridge cases examination; comparison of fired shot shells; and projectiles examination. Average Weighted Means Formula M=∑fx N Where: M- refers to the weighted mean of the ballistics subject in analyzing the data, the following scale intervals would be used. Ranges Verbal Interpretation Descriptive Equivalent (4) Fully Implemented (FI) (3) Implemented (I) (2) Less Implemented (1) Not Implemented (NI). Assessment in the crime laboratory is a part of curriculum implementation which allows the crime laboratory instructor to track and measure learners' progress and adjust instruction accordingly. The grading system in the criminology program uses standard and competency-based. All grades would be based on the weighted raw score of the learners. The minimum grade needed to pass a specific learning area is 60, which the translated into 75 on the report card. In assessing the level of criminology students' performance in crime laboratory exercises, the researcher used a written activity consisting of 100 competency-based Items. A Table of Specifications was used to identify the achievement domain. In transmuted grade 95-100 (90.00-100) descriptive equivalent is outstanding, and description is very high. 90-85 (80.00-89.99) Very satisfactory, description as high. 80-85 (70-79.99) satisfactory description as moderate, 75-70 (60-69.99) Fairly Satisfactory as low, 70-65 and below did not meet expectations as very low.

Ethics consideration is the fundamental issue of practical decision-making. Its major concerns include the nature of ultimate value and the standards by which human actions can be judged right or wrong as defined in Britannica (2021). Several ethical issues arose in this study. These include obtaining permission to research the Kapalong College of Agriculture Sciences and Technology (KCAST) and Kolehiyo ng Pantukan (KNP); obtaining permission from school administrators; only voluntary participants took part; undertaking to treat all gathered information with confidentially by protecting the identity of participants as well as not identifying the participating respondents. All the participants were informed about the aims, objectives, motivation, and reason for the study and what it set out to accomplish. The researcher made all possible attempts to note down all the findings in this study as accurately and objectively as possible. Considering the COVID-19 pandemic, the researcher made necessary adjustments to prevent disruptions in the production of statistical data for this study. Moreover, the researcher considered himself responsible for observing the health protocol and statistical enumerators as well as respondents for this undertaking.

RESULTS AND DISCUSSIONS

This part of the paper presents the assessments of the respondents on the Implementation of Forensic Ballistics Laboratory Activities of the Students in the Community College in Region XI.

Table 1

Status on the implementation of Forensic ballistics lab activities in terms of identification of firearms.

Item	Ranking	WM	DV
1. Conduct an activity to identify the firearms in the crime laboratory	7	3.01	A
2. Identify a firearm by its model caliber and serial number.	4	3.06	A
3. Use a comparison microscope to identify firearms	3	3.47	A
4. Identify the types of firearms in the crime lab activity.	2	3.52	SA
5. Marks engraved on the barrel of the guns indicate the model made.	10	2.79	A
6. Use fiber wadding to identify the gauge of a firearm.	8	2.98	A
7. Mark the caliber or gauge of the Firearm	1	3.56	SA
8. Conduct a measurement activity to identify the firearms	7	3.01	A
9. Examine the mechanical action of the firearm to identify	5	3.04	A
10. Put on magnetic methods, chemical etching, and electrolysis to identify the firearm	6	3.03	A
Total	3.19	Agree	

Legend: 3.51 - 4.00 (Strongly Agree-SA); 2.51 - 3.50 (Agree-A); 1.51 - 2.50 (Less Agree-LA); 1.00 - 1.50 (Disagree-D)

Table 1 shows the status of the implementation of Forensic ballistics laboratory activities in terms of identification of firearms in the two Local Community Colleges of Region XI. The data presented that the assessment of the respondent's status in all Items agreed on the implementation. Item No.7, *Mark the caliber or gauge of the Firearm* got the highest weighted mean (3.56) rank (1) while Item No. 5, *Marks engraved on the barrel of the guns indicate the model made* got the lowest weighted mean (2.79) rank (10) which have a descriptive value agree on the implementation.

Identification of firearms. According to Firearms Principles (2021), the activity in the Crime laboratory of forensic ballistics subject was conceptualized to instill awareness in students' minds for analyzing the bullets and to determine whether cartridge cases collected at a crime scene came from a particular firearm. In a statement by Janson (2021), during the examination in which firearms are suspected, every gun is collected for examination, including cartridge cases, bullets, live ammunition, trace materials, and any material damaged by a projectile must be carefully examined. It shows that the respondents were content with the teaching approach by the aforementioned Crime laboratory for the forensic ballistics subject being implemented. According to NIJ, OJP (2021), the Crime laboratory activity may help students increase their ability to conduct activities related to firearms identification and their surroundings at a crime scene. Thus, provide various types of evidence.

Table 2.

Item	Ranking	WM	DV
1. Unload all weapons before using them in the Crime laboratory.	5	3.10	A
2. Use a water tank/recovery box in the crime lab to test fire.	6	3.06	A

3. Compare firearm mechanisms with Standards	3	3.51	SA
4. Use a Comparison Microscope to conduct a comparison of the firearm.	2	3.53	SA
5. Using the stereoscopic to compare the firearm.	10	2.89	A
6. Test the firearm using magnification to determine the individual characteristics	8	3.03	A
7. Determine the brand and model in comparing a firearm.	1	3.62	SA
8. Compare to measuring the bore diameter of a firearm.	7	2.94	A
9. Examine the barrel class characteristics	6	3.06	A
10. Use protective equipment, such as gloves, lab coat, and safety glasses	4	3.12	A
Total		3.26	Agree

Status of the implementation of Forensic ballistics laboratory activities in terms of a comparison of firearms.

Legend: 3.51 - 4.00 (Strongly Agree-SA); 2.51 - 3.50 (Agree-A); 1.51 - 2.50 (Less Agree-LA); 1.00 - 1.50 (Disagree-D)

Table 2 reveals the respondents' assessment of the status of the implementation of Forensic ballistics laboratory activities in terms of a comparison of firearms. Based on the data, the No.7 Item is ranked (1) with the statement, *Determine the brand and model in comparing a firearm* and assessed as Strongly Agree on the implementation with a weighted mean of 3.62. Items 2 and 9 have the same weighted mean (3.06), *Use a water tank/recovery box in the crime lab to test fire* and *Examine the barrel class characteristics*. Item No. 4 ranks (2), *Use a Comparison Microscope to conduct a comparison of the firearm* (3.53), *Compare firearm mechanisms with Standards* and *Using the stereoscopic to compare the firearm* (3.51), Item No. 3, rank (3), while Item 10 (3.12) rank (4), Use *protective equipment, such as gloves, lab coat, and safety glasses,* Item 1 (3.10) rank (5) unload all weapons before using in the Crime laboratory. Item (8) (2.94) ranks (7) *Compare to measuring the bore diameter of a firearm* and *Determine the individual characteristics* and Item 10 (3.12) ranks (10), *Use the stereoscopic to compare the firearm with another firearm*. The total weighted mean (3.26) as Agreed on the implementation.

Comparing firearms is an important part of criminal investigations because "every firearm tells a story", Unodc. org (2021). During investigations in which the use of firearms is suspected, several are artifacts collected for examination, including firearms, cartridge cases, bullets, live ammunition, trace materials, and any material damaged by a projectile. Based on the statement by Kumar, et al. (2020) comparing firearms activities, students have developed more ideas about the skills and techniques in performing ballistics forensic examinations.

Table 3

Status of Forensic ballistics lab activities in terms of Cartridge Cases Examination.

Item	Ranking	WM	DV
1. Examine cartridges in the crime laboratory.	1	3.61	SA
2. Verify the marks on the breech of the face of the cartridges.	6	3. 27	A
3. Check the firing pin impressions in the examination of the cartridge	3	3.53	SA
4. Use extractors and ejectors to mark an examination cartridge	4	3.52	SA
5. Use the marks caused by an expansion in the cartridge case	9	2.97	A
6. Mark the gun barrel by the land, grooves, and the fine striations	8	3.04	A

7. Use a Comparison Microscope in examining the cartridge case.	2	3.59	SA
8. Examine the firing pin contact of a cartridge during extraction and ejection.	10	2.95	A
9. Prove the striated marks produced on the periphery of a cartridge	7	3.24	A
10. Use collected bullets from the crime scene as for the cartridge examination.	5	3.44	A
Total		3.27	Agree

Legend: 3.51 - 4.00 (Strongly Agree-SA); 2.51 - 3.50 (Agree-A); 1.51 - 2.50 (Less Agree-LA); 1.00 - 1.50 (Disagree-D)

Table 3 presents the respondents' assessment of the status of Forensic ballistics laboratory activities in terms of cartridge case examination. The data revealed that all Items rated under this component Agreed on the *implementation*. (3.27). Items 1, 3, 4, and 7, Examine *cartridges in the crime laboratory* (3.61) rank (1). *Check the firing pin impressions in the cartridge's examination* (3.53) rank (3*), Use extractors and ejectors to mark an examination cartridge* (3.52) rank (4), and *Use a Comparison Microscope in examining the cartridge case*. *Use a Comparison Microscope in examining the cartridge* case (3.59) rank (2), all Items under this component were rated Strongly Agree on the implementation. Item No. 10 (3.44) rank (5), *Use collected bullets from the crime scene for the cartridge examination,* Item No. 6 (3.27) rank (6) verifies marks on the breech face of the cartridge, Item No. 9 (3.24) rank (7) proves the striated marks produced in the periphery of a cartridge and, Item No.6 (3.04) rank (8) marks the gun barrel by the land grooves and the fine striations Item No. 9 (2.97) rank (9) uses the marks caused by an expansion in the cartridge case while examining the firing pin contact of a cartridge during extraction and ejection with a descriptive value of Agree on the implementation.

In light of the respondent's assessment regarding the implementation result of the cartridge case examination assessment. Because of the Crime Lab activities, additional skills and techniques have been developed. Based on their response, implementing forensic ballistics activities.

Table 4

Status of Forensic ballistics lab activities in terms of comparison of Fired shot shells.

Item	*Ranking*	*WM*	*DV*
1. Conduct a comparison of fired and unfired cartridges and shells	7	3.08	A
2. Observe the policies in the conducted comparison of fired shot shells.	4	3.31	A
3. Remove the cylinder when comparing fired shot shells.	2	3.64	SA
4. Document basic descriptive information before any examination	1	3.67	SA
5. Clean shot shells with cotton-tipped swabs saturated with ethanol	6	3.10	A
6. Mark all evidence cartridge cases and shells for identification.	8	3.07	A
7. Use a micrometer with a fixed measuring surface	3	3.56	SA
8. Take note of the characteristics of fire projectile conducts in comparison.	3	3.56	SA
9. Inspect firearms that fired projectiles that had a rifling characteristic.	9	2.89	A
I0. Indicate the condition of the projectile in comparison to a fire shot shell.	5	3.32	A
Total		3.15	Agree

Legend: 3.51 - 4.00 (Strongly Agree-SA); 2.51 - 3.50 (Agree-A); 1.51 - 2.50 (Less Agree-LA); 1.00 - 1.50 (Disagree-D)

Table 4 reveals that respondents' students assessed the status of Forensic ballistics lab activities in terms of comparison of Fired shot shells and agreed on the implementation with the weighted mean (3.15). Specifically, Item No. 1 states *Document basic descriptive fired shot shells before examination* rated (3.67) rank (1) which descriptive value, the activity was strongly agreed upon implementation and, Item No. 3 (3.64) rank (2), *Removes the cylinder when comparing fired shot shells* rated (3.56), Item No. 7 ranks (3), *Use a micrometer with a fixed measuring surface*.

The result further revealed that Item No. 4 (3.31) observes the policies in the conducted comparison of fire shot shells, Item No.10, (3.32) rank (5) shows the condition of the projectile compared to a fire shot shell, and Item No. 5 (3.10) rank (6) cleans shot shell with a cotton-tipped swab saturated with ethanol. Item No. 1 rank (7), *Conducts a comparison of fire and unfired cartridges and shells.* Item No. 6 (3.07) rank (8), *Mark all pieces of evidence of cartridge cases and shells for identification*. Item No.10 (2.89) rank (9), *Indicate the condition of the projectile in comparison to a fire shot shell* got the weight value with a descriptive of agree on implementing the forensic ballistic in the crime laboratory activities. Based on the statement of Ensicyard.Com (2020) that the comparison fired shot shell is the fire primary markings were left by the gun barrel's lands and grooves and revealed the fine striations in all the marks.

This finding is in consonance with the instruments specially designed to permit the firearm examiner to determine the similarity and dissimilarity between two fired bullets or two fired shells. Therefore, this finding of Crime Laboratory activities comparing fired shot shells Laboratory experiences may facilitate a student's learning of concepts in analyzing fired-cartridge scientific examination.

Table 5

Status of Forensic ballistics lab activities in terms of Projectile Examination.

Item	*Ranking*	*WM*	*DV*
1. Conduct projectile examination in the crime laboratory.	6	3.08	A
2. Calculate the distance and time using the motion formula in projectile examination	2	3.43	A
3. Obtain test bullets for comparison by test-firing the recovered firearm.	7	3.07	A
4. Compare the evidence of a firearm test bullets with a standard test gun	10	2.47	A
5. Comparing recovered bullets to determine if they are related	8	3.01	A
6. Reproduce test-fired bullets as microscopic marks for comparison	1	3.50	SA
7. Using a micrometer with a fixed measuring surface in comparison	9	2.80	A
8. Taking note of the characteristics of fired projectiles for the comparison	3	3.42	A
9. Check the firearms that fired projectiles had a rifling characteristic.	4	3.40	A
10. Indicate the type or condition of a projectile in comparison to the projectile.	5	3.32	A
Total		3.42	Agree

Legend: 3.51 - 4.00 (Strongly Agree-SA); 2.51 - 3.50 (Agree-A); 1.51 - 2.50 (Less Agree-LA); 1.00 - 1.50 (Disagree-D)

Table 5 illustrates the respondents' assessment of the status of Forensic ballistics lab activities in terms of Projectile Examination. The data showed the respondents rated all Items agreed on the implementation (3.42). Item No. 4 ranks (10), statement C*omparing the evidence of a firearm's test bullet with a standard test gun*. *Comparing recovered bullets to determine if they are related*, which has the lowest weighted mean (2.47), with a descriptive value of Agree to implement, whereas Item No. 6 got the highest WM (3.50) came from the rank (6), *Reproduces test-fired bullets as microscopic marks for comparison*. Having a descriptive Agrees value on the implementation.

The result signifies that the data revealed supports the statement of the Physics classroom. Com (2021), the examination of a projectile body projected by external force and continuing motion by its inertia especially a missile for a weapon. A projectile is any object that once projected or dropped continues in motion by its inertia and is influenced only by the downward force of gravity. The results are under the main aim in the conduct of forensic ballistics examination of fire projectiles. This result supported the statement of Leblond (2020) that the school Crime Lab is a great place for students, which helps them enhance their learning by understanding the theoretical concepts of science that are taught in the classroom, and their developing scientific reasoning abilities, increasing understanding of the complexity and ambiguity of empirical work, developing practical skills in the Crime Laboratory.

Table 6

Level of the academic performance of students who are enrolled in forensic ballistics laboratory activities in the Local Community College in Region XI.

Item	*Ranking*	*WM*	*DV*
1. Firearms Identification	4	3.15	Agree
2. Comparison of firearms	3	3.19	Agree
3. Cartridge case examination	2	3.26	Agree
4. Comparison of fired shot shell	1	3.27	Agree
5. Projectile examination	4	3.15	Agree

Legend: 3.51 - 4.00 (Strongly Agree-SA); 2.51 - 3.50 (Agree-A); 1.51 - 2.50 (Less Agree-LA); 1.00 - 1.50 (Disagree-D)

Table 6 shows the level of academic performance of students who are enrolled in forensic ballistics laboratory activities in the Local Community College in Region XI. As shown in the table, statement *Comparison of fire shot shells* got the highest score of 3.27. Followed by C*artridge case examination* with 3.26, *Comparison of firearms* with 3.17, and *Firearms identification and Projectile examination* both got the lowest score of 3.15 with an overall descriptive value Agree on implementing forensic ballistics activities.

The result indicates that the implementation of forensic ballistics activities in the crime laboratory shows that both Local Community College in Region XI, wherein their graduating criminology students can identify significant features of a particular firearm design in the fired projectiles and fired cartridge cases, as well as tool marks on ammunition components that are not caused by firearms. Forensic ballistics laboratory activities and experiences may help students to understand more about the comparison of fire shot shells, and examining fired shot shells and projectiles that scientific theories, models, and explanations change over time based on new evidence.

Table 7

A significant relationship between the forensic ballistics laboratory activities and student's performance in the Local Community College in Region XI.

Item	WM	DV
1. Kapalong College of Agriculture Sciences and Technology	70.41	Fairly Satisfactory
2. Kolehiyo ng Pantukan	70.37	Fairly Satisfactory
Total	70.28	Fairly Satisfactory

Legend: 95-100, Very Outstanding; 90-85, Very High; 80-85, High; 75-70, Moderate; 70-65, Fairly Satisfactory; 65-below, Very low

Table 7 shows the academic performance of students in the activities implemented in the crime laboratory of the two local community colleges in Region XI. Based on the data, each of the schools was rated fairly satisfactory by their students' respondents. The results further revealed that the Kapalong College of Agriculture, Sciences, and Technology got the highest mean value of 70.42, while the Kolehiyo ng Pantukan forensic ballistics activities got the mean value of 70.37. Because of the forensic ballistics activities, student respondents expressed fairly satisfaction with how Region XI, particularly the two Community Colleges implemented the activities in forensic ballistics in the Crime laboratory.

Table 8

Test of Correlation between Forensic Ballistics Laboratory Activities and Academic Performance

Variable	Mean	r-value	p-value	Decision
1. Forensic Ballistics laboratory activities	3.29			
2. Academic Performance	70.28	0.020	0.842	H0 Accepted

Note: Table 8 indicates that the computed r-value of 0.020 is greater than the p-value of 0.842. It connotes that there is a significant relationship between Forensic Ballistics Laboratory Activities and the Academic Performance of the students in their activities implemented in the crime laboratory.

This portion presents the summary of findings which is the basis for conclusions and recommendations. Presented hereunder is the summary of the study, as follows: The 102 respondents were composed of the two Local Community College in Region XI, the Kapalong College of Agriculture, Sciences and Technology (KCAST) and Kolehiyo ng Pantukan (KNP) whose graduating students had performed the forensic ballistics activity to be assessed on how they performed during the laboratory activity. Moreover, the status of Crime laboratory activities of the Forensic ballistics courses under the Criminology program of the two Local Community Colleges in Region XI is generally assessed as agreed on the implementation.

Ranked based on the Weighted Mean, the *Comparison of fired shot shell* (3.27) followed by *Firearm identification* (3.19) P.D. followed by *Cartridge case examination* (3.26), *Comparison of firearms* (3.19), and *Firearms Identification* (3.15). Further, the implementation of forensic ballistics laboratory activities in local community colleges in terms of the identification of firearms. The three statements were among the lowest: *Marks engraved on the barrel of the guns indicate the model made; Conduct a measurement activity to identify the firearms*; and *Identify the firearm by their model, caliber, and serial number*. Implementation in terms of comparison of firearms. Three statements rated the lowest: *Use the stereoscopic to compare the firearm*, *Compare the firearm to measure the bore diameter*, and *Test a firearm using magnification to compare the individual characteristics*.

Implementation in terms of *Cartridge case examination*, three statements rated the lowest: *Marks on the gun barrel by the land, grooves*, T*he fine striations prove the striated marks produced on the periphery of a cartridge*, and *Use a Comparison Microscope in examining the cartridge case*. Implementation in terms of comparison of fired shotshells. One statement rated lowest-*Inspect firearms that fired projectiles had a rifling characteristic*. Implementation in terms of projectile examination. Two statements rated lowest: *Make use of a micrometer with a fixed measuring surface in comparison*, and *Compare the evidence of the firearm's test bullets with a standard test gun*.

The results also presented the diversity of outcomes assessment. The Average Weighted Means of the evaluation made by the graduating students' respondents of the two Local Colleges. The weighted mean test results further revealed there is a significant relationship between the respondents in terms of the forensic ballistics laboratory activities and students in their activities implemented in the crime laboratory in two Local Community colleges in Region XI. Kapalong College of Agriculture, Sciences, and Technology got the highest Weight Mean Value of 70.42, while at the Kolehiyo ng Pantukan, the forensic ballistics activities got the Weight Mean Value of 70.37. Based on the foregoing findings, the researcher has drawn the following conclusions: The implementation of Forensic Ballistics in the two Community College in Region XI of the Crime laboratory of the four activities, Firearms Identification, Comparison of firearms, Cartridge case examination, Comparison of Fired Shotshell and Projectile Examination. The result was rated agree on the implementation through the Criminalistics Instructor's scheme complying with a syllabus of the course, and Crime Laboratory equipment under the curriculum of the Bachelor of Science in Criminology program.

CONCLUSION

Based on the findings and in consonance with the Memorandum Order No. 5 series of 2018 by the Commission on Higher Education (CHED) states that one of the roles of institutions is to produce graduates who possess the knowledge and skills of forensic ballistics specialists. The respondents perceived the status of each component of the forensic ballistics activities in the Crime laboratory based on their own experience, understanding, and standard of performance. This was clear in the diversity of assessments based on the results of the study. Nevertheless, the data revealed that the status of implementation of each school of respondents that is, the graduating students in the two Community Colleges of Region XI Davao del Norte was fairly satisfied with the implementation but not high. The main aim of the study is to determine the status of forensic ballistics laboratory activities and students' performance implementation in the two (2) Colleges.

The following **recommendations** are drawn by the researcher based on the findings and conclusions: For the implementation of forensic ballistics, the laboratory must set additional lessons of activity for the identification of firearms.

1. The researcher strongly suggests that the activities that are currently used for students should be revisited and should be assured that they are compliant with Memorandum Order No. 5 series of 2018 by the Commission on Higher Education (CHED);
2. The institution should have modified curriculum rubrics focusing on producing graduates who possess the knowledge and skills of forensic ballistics. They must be organized further and include instructional designs and materials in conducting a measurement by using different laboratory tools to Identify the firearms; and
3. Activities should consider discovery-based learning which is based on students' own experience, understanding, and standard of performance.

a. **Firearm Comparison.** The firearm comparison must have an extra set of enhanced instructional delivery of activities for students, as follows:

1. Using the stereoscopic equipment to compare the types of firearms;

2. They also prepare the lessons for the further activity of comparison of firearms in the crime laboratory which could provide more additional activities;
3. Must also be prepared to demonstrate how to measure the bore diameter of the student's arms in the crime laboratory activity where they can learn how to analyze and compare; and
4. Instructional materials must also be prepared to test a firearm using magnification to compare its characteristics and understanding of the comparison of the firearms.

b. **Cartridge Cases Examination.** Must prepare a lesson that intends to provide more knowledge and information to the students who performed a forensic ballistics activity in the crime laboratory, as follows:

1. These activities include the marks on the gun barrel by the land, grooves, and fine striations, which prove striated marks produced on the periphery of a cartridge case; and
2. Using a Comparison Microscope in examining the cartridge case.

c. **Comparison of Fired Shotshells.** There must be additional lessons and instructional materials in conducting activities to inspect firearms that fired projectiles that had a rifling characteristic in the crime laboratory where the students are getting more knowledge and information in studying their forensic ballistics subject.

d**. Projectile Examination.** Must create an extra lesson for the crime laboratory activities to make use of a micrometer with a fixed measuring surface in comparison, and compare the evidence of the firearm's test bullets with a standard test gun where the students can conduct in measuring and compare the shape and size with the standard of the test bullets.

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