

# Competency of Criminology Students in Forensic Science Subjects: Implications to Outcome-Based Education in Albay

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## Abstract

**Aim:** This study aimed to evaluate the current state of forensic science education among criminology students in the Second District of Albay, Philippines. Specifically, it assessed their competency levels in various forensic science subjects and examined how institutional factors—such as the availability of laboratory equipment, instructor qualifications, and teaching methodologies—affect student preparedness for real-world applications. The study also sought to identify existing gaps in instruction and resources that may hinder the development of essential forensic skills.

**Methodology:** The study utilized a descriptive-correlational design with a quantitative approach. Participants included 247 fourth-year criminology students, 15 instructors, and 2 laboratory custodians from three selected institutions. Student competencies across six forensic science disciplines were assessed using a structured questionnaire, while institutional status was evaluated through a survey tool aligned with the standards of CMO No. 5, series of 2018. Descriptive statistics (mean and percentage) summarized the data, and Kendall's correlation and chi-square tests were used to analyze the relationship between institutional factors and student competencies.

**Results:** The findings revealed a significant relationship between the quality of institutional support (equipment, faculty, methodology) and students' competency in practical forensic science applications. Well-equipped institutions with qualified instructors and dynamic teaching strategies produce more competent students, reinforcing the core principle of Outcome-Based Education.

**Conclusion:** There is a strong positive correlation between institutional factors and the competency levels of criminology students in forensic science subjects, highlighting the need for improved resources and teaching methodologies to enhance educational outcomes.

**Keywords:** Theoretical Application, Practical Application, Forensic Science, Competency of Criminology Students, Criminology, Forensic Science, Outcome-Based Education, Competency, Institutional Resources, Albay

## INTRODUCTION

The study of criminology has evolved significantly in recent years, placing increased emphasis on practical expertise and specialized knowledge, particularly in forensic science.

The recent publication of the International Organization for Standardization (ISO) 9001:2015 and ISO/International Electrochemical Commission (IEC) 17025:2017, along with the first book on quality management in forensic science, has prompted a global review of forensic education and practice. These publications introduce significant changes to the structure, content, and scope of forensic science standards, impacting forensic science education and practice worldwide. (Barradas & Sampaio, 2021) However, the disparity in resources and technological infrastructure between the Global North and Global South remains a pressing issue. The concept of a hierarchy is introduced as a means of classifying standards to better navigate the crowded landscape. The main body of the review identifies risks to the QSF and opportunities for improvement. (Doyle, 2019)

The concept of "frugal forensics" is introduced, demonstrating how resource-efficient approaches can be implemented for latent fingermark detection in Global South contexts, while maintaining robust quality assurance systems to support these efforts. (Bouzin et al., 2023) The new pedagogical approach of teaching and learning

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provides better deliverables by the teachers and better understanding and student engagement. In this order, a course was designed on Forensic Science for undergrad students from interdisciplinary backgrounds. The suggested approach may be helpful in reducing the theoretical and practical gap in forensic science education. Besides, this teaching and learning approach may open a new avenue of forensic research and may result in a paradigm shift. (Shukla, 2021b)

In the Philippines, criminology students can pursue a Bachelor of Science in Criminology degree program, which includes subjects such as Police Photography, Ballistics, Forensic Science, Toxicology, Polygraphy, and Legal Medicine. The Professional Regulation Commission (PRC), through the Criminologist Licensure Examination, mandates that criminology graduates demonstrate proficiency in these areas, as outlined in Republic Act No. 11131 and its Implementing Rules and Regulations (IRR) published in 2020. These regulations emphasize the need for accredited institutions to provide adequate training in both technical and scientific aspects of crime detection and investigation, reinforcing the importance of practical competencies in the field.

In Region V or Bicol Region, there are 31 higher education institutions offering Bachelor of Science in Criminology courses. The Criminologist Licensure Examination mandates that graduates demonstrate broad competencies in forensic science, yet many institutions in regions such as Albay struggle to meet the practical training requirements. Custodio (2023) examined training practices within law enforcement agencies in Albay and found that inadequate practical training and unsafe practices can contribute to issues such as abuse of authority and police misconduct. The criminology programs in Region V continue to provide students with a quality education and the skills they need to succeed in their chosen careers.

This study, conducted in the Second District of Albay—encompassing Guinobatan, Daraga, and the capital city of Legazpi—examines the competency levels of criminology students in forensic science subjects. Colleges emphasized the use of forensic tools like polygraph machines and microscopes, demonstrating the value of equipment utilization in enhancing forensic science education. (Malvar, 2024) This research aims to close the gap between theoretical learning and practical application, thereby improving the overall competency of students. The study addresses the following key issues: The current state of forensic science education in the Second District of Albay, focusing on laboratory equipment and instructional quality.

The study identified a significant gap in forensic science education in the Second District of Albay, where a lack of adequate resources and practical learning opportunities hampers criminology students' ability to develop essential forensic competencies. This gap affects the students' preparedness for real-world applications in law enforcement agencies, which rely heavily on forensic techniques. The research aimed to assess these competencies, examine the factors contributing to the gap, and propose solutions to enhance forensic science education in the region.

## Objectives

The primary focus of this study is to assess the competency levels of criminology students in their forensic science courses, with a specific emphasis on aligning these levels with the outcome-based education strategy of the province of Albay. The research established a benchmark of proficiency that not only meets the educational goals of the province but also ensures that students are adequately prepared for practical application in the field of forensic science.

Specifically, the study has the following objectives:

- 1. determine the status of the institution in terms
  - a. Laboratory Equipment/ facility
  - b. Instructors Qualification
  - c. Teaching Methodology
- 2. assess the competency of the criminology students in the six areas of forensic science in the criminology program along
  - a. Theoretical concept
  - b. Familiarization on Practical application
- 3. determine the significant relationship between the status of the institution and the competency of the students.
- 4. infer the significant agreement among the ranks on the competencies of Criminology Students on the above-mentioned variables.

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5. formulate a standard Outcome Based Education Laboratory Manual in all areas of Forensic Science and proposed Action Plan.

## **Hypothesis**

 $H_0$ : There is no significant relationship between the status of the institution and the competency of the students in forensic science subjects.

 $H_{a:}$  There is a significant relationship between the status of the institution and the competency of the students in forensic science subjects.

 $H_0$ : There is no significant agreement among the ranks regarding the competencies of criminology students in forensic science subjects.

 $H_{a:}$  There is a significant agreement among the ranks regarding the competencies of criminology students in forensic science subjects.

## METHODS

## **Research Design**

This study utilized a descriptive-correlational research design to assess the competency levels of criminology students in forensic science subjects and their alignment with the Outcome-Based Education (OBE) approach. The descriptive aspect systematically analyzed institutional factors such as laboratory facilities, instructors' qualifications, and teaching methodologies, while the correlational aspect explored relationships between these factors and student competency levels

## **Population and Sampling**

The research was conducted in three selected institutions within District II of Albay Province, Philippines, involving a total of 264 participants. The respondents included 247 fourth-year criminology students, 15 instructors teaching forensic science subjects, and 2 laboratory custodians. Students were purposively selected based on their academic standing and completion of forensic science subjects, ensuring they were well-positioned to provide insights into competency outcomes.

#### Instrument

The study utilized a structured quantitative instrument consisting of two parts. The first part measured students' theoretical knowledge in six forensic science disciplines through a 30-item multiple-choice questionnaire. The second part assessed familiarization on practical competency using a 4-point Likert scale, ranging from "Not Competent" to "Highly Competent." To evaluate the institutional status, including laboratory facilities, instructor qualifications, and teaching methodologies, a separate survey tool was developed for faculty members and laboratory custodians. This tool was crafted in alignment with the standards of the Commission on Higher Education (CHED) Memorandum Order (CMO) No. 5, series of 2018. The instruments underwent content validation by subject matter experts in forensic science and criminology education before distribution.

## **Data Collection**

Data collection was conducted in December 2023 across three criminology schools in the province of Albay. The researcher began the process by formally coordinating with the school administrators and securing approval for the distribution of research instruments. Upon approval, the structured questionnaires were personally administered to fourth-year criminology students in their classrooms under the supervision of the researcher and faculty representatives to ensure consistency. The environment was controlled and conducive to answering, with ample time allotted for completion. Simultaneously, the institutional survey forms were distributed to instructors teaching forensic science subjects and to designated laboratory custodians. Completed forms were collected on the same day or within the agreed timeframe set by the institutions.

#### **Treatment of Data**

Quantitative data were analyzed using descriptive statistics to summarize competency levels, while the Chi-Square Test for independence was applied to examine relationships between institutional factors and student competencies. Kendall's Coefficient of Concordance was calculated to analyze agreement among ranks on student competencies across different schools.

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## **Ethical Considerations**

The study strictly adhered to established ethical research protocols to ensure the integrity and credibility of the research process. Before data collection, participants were fully informed about the purpose, scope, and objectives of the study. Informed consent was obtained from all respondents, emphasizing their voluntary participation and right to withdraw at any time. Additionally, official permission was secured from the presidents and deans of the participating institutions, ensuring administrative compliance and institutional support. All responses were treated with the utmost confidentiality, and participants' identities were protected through anonymous data handling procedures.

## **RESULTS and DISCUSSION**

In this section, the results and discussion analyzed the competency levels of criminology students in forensic science subjects across three educational institutions—School A , School B and School C while maintaining confidentiality through coded designations, to draw important conclusions and insights about the forensic science education environment and the competency levels among these institutions.

# The Status of the institution in Laboratory Equipment/facilities, Instructors qualifications and teaching methodology.

This study assessed the status of the institution in the delivery of forensic science education by evaluating three critical components: laboratory equipment and facilities, instructors' qualifications, and teaching methodology, guided by the standards set forth in CMO No. 5, Series of 2018.

## a. The Status of the Institution in Laboratory Equipment and Facility.

In Forensic Photography, all three schools are poorly equipped, limiting students' ability to apply theoretical knowledge in practical settings and hindering their skill development. For Personal Identification Techniques, School B is fully equipped, while Schools A and C are moderately equipped, resulting in uneven opportunities for practical learning and skill acquisition across the schools. In Forensic Toxicology and Chemistry, School A is fully equipped, whereas Schools B and C are moderately equipped, highlighting the importance of resource availability for competency development. Lastly, in Lie Detection Techniques and Forensic Ballistics, Schools A and B are fully equipped, while School C is moderately equipped, leading to disparities in practical skill proficiency among students. The differing levels of laboratory equipment compliance among criminology schools in Albay mirror global research emphasizing the impact of infrastructure and gualified personnel on practical learning. Wekwe et al. (2024) revealed that 80% of public schools in Ubungo lacked qualified lab technicians, limiting students' hands-on experience and negatively affecting performance—a trend reflected in this study, where all schools were only moderately compliant in Forensic Photography. School B's superior equipment in several forensic areas correlates with increased student competency, supporting Wekwe et al.'s assertion that facility quality directly influences learning outcomes. Odhiambo et al. (2022) further emphasized the role of national accreditation systems like SLIPTA and SLMTA in enhancing lab standards and achieving ISO 15189 accreditation, highlighting the value of standardized, guality-assured criminology laboratories. Similarly, Basnet et al. (2022) found that poor infrastructure and inadequate training during COVID-19 in Nepal reduced staff effectiveness and satisfaction, reinforcing that both institutional support and resources are vital. Collectively, these findings advocate for improved laboratory facilities and personnel qualifications to strengthen Outcome-Based Education and promote equitable skill development in forensic science.

## b. The Status of the Institution for Instructor Qualification.

The evaluation of instructors' qualifications across Schools A, B, and C indicates significant variations that directly influence the quality of education in forensic science. Instructors are categorized as highly qualified, moderately qualified, or less qualified, depending on their academic credentials and experience. The presence of highly qualified instructors in critical areas such as Forensic Photography and Lie Detection Techniques suggests a strong educational experience for students. However, the predominance of moderately qualified instructors in Personal Identification Techniques and Forensic Ballistics may limit students' depth of understanding and practical skills. Particularly concerning is School B, which has less qualified instructors in Forensic Toxicology and Chemistry, raising doubts about the adequacy of training in this essential area. This highlights the need for educational institutions to prioritize faculty development and recruitment to ensure that students are adequately prepared for careers in forensic science. The findings align with existing literature that emphasizes the impact of instructor

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qualifications on student outcomes. The analysis of instructor qualifications across the six major forensic science areas reveals critical gaps, particularly in Personal Identification Techniques and Forensic Ballistics, where no schools have subject specialists—raising concerns about the depth of technical instruction. This aligns with the Global Education Monitoring Report (2023), which warns that inadequate faculty preparation and institutional support can exacerbate student competency gaps.

# c. Institutional Status in Teaching Methodology.

The examination of teaching methodologies reveals distinct patterns among the schools. School A relies heavily on traditional methods, particularly in Forensic Photography, Questioned Document Examination, and Forensic Ballistics, which may limit students' practical exposure. In contrast, School B employs a mixed approach, balancing theory and practice, particularly in subjects like Forensic Photography and Questioned Document Examination. School C's innovative methodology in Lie Detection Techniques and Forensic Ballistics suggests a progressive teaching strategy that leverages modern technology and simulations. This variation indicates that Schools B and C may offer more practical and diverse learning experiences, while School A's reliance on traditional methods could restrict hands-on exposure. The findings reflect contemporary educational theories that advocate for a mix of teaching methodologies. Research highlights the importance of practical training in developing competencies in forensic science.

The study highlights notable differences in teaching methodologies among the three criminology schools, with School A relying heavily on traditional lectures—potentially limiting practical exposure—while School B employs a mixed approach and School C adopts innovative strategies, particularly in Lie Detection Techniques and Ballistics, enhancing student engagement and skill development. These findings support Craig et al. (2020), who found that methods like Team-Based Learning improve critical thinking and retention, and Lattas et al. (2024), who emphasized the value of experiential learning in preparing students for real-world challenges. Additionally, research by Mensah et al. (2020) and Gabasa & Raqueño (2021) links instructional quality directly to student readiness for licensure and professional application, while Bautista et al. (2018) tie ineffective teaching methods to declining national exam performance. Collectively, the evidence underscores the importance of integrating innovative, practice-based pedagogies aligned with the Outcome-Based Education (OBE) framework to enhance competency and career readiness in criminology students.

## Competencies of the three groups of Criminology Students in the six areas of Forensic Science.

In the evolving field of criminology, proficiency in forensic science is crucial for aspiring professionals by evaluating students' theoretical knowledge and practical skills, this research aims to identify strengths and areas for improvement, providing insights that can enhance educational outcomes and better prepare future criminologists for the challenges of their profession.

### a. The Students' Competency in Theoretical Application in Forensic Science.

The theoretical application competency of criminology students across three schools—A, B, and C—in various forensic science areas is significantly influenced by institutional factors such as laboratory equipment, instructor qualifications, and teaching methodologies. While all schools demonstrate a promising understanding of lie detection techniques due to adequate resources and qualified instructors, challenges arise in forensic ballistics, where a lack of specialized training hampers theoretical mastery despite the use of innovative teaching methods. In forensic photography, the traditional approach in School A limits depth of comprehension compared to the mixed methodologies employed by Schools B and C, which promote engagement and active learning. Conversely, School A excels in forensic toxicology and chemistry, benefiting from modern resources and trained faculty. The analysis indicates that a holistic institutional support system—integrating qualified instructors, sufficient facilities, and updated teaching strategies—is essential for fostering strong theoretical competencies. The findings suggest a pressing need for enhanced teaching methodologies, particularly experiential learning opportunities, to bridge the gap between theoretical knowledge and practical application, ultimately ensuring that criminology students are well-prepared for professional challenges in forensic science. Regular curriculum evaluations and collaborative efforts among educational institutions and industry partners are recommended to align educational practices with the evolving demands of the field.

The theoretical application competency of criminology students in forensic science is significantly influenced by institutional factors such as laboratory facilities, instructor qualifications, and teaching methodologies. A strong academic foundation in natural sciences is essential for forensic scientists, as highlighted by Sosa-Reyes et al. (2022) emphasize the need for interdisciplinary teaching strategies and clearly defined competencies, while Bryce et al.

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(2019) stress the importance of competency assessment schemes for real-world readiness. The current study supports these findings, showing that students achieve better theoretical understanding in well-supported environments, such as in Lie Detection Techniques, where adequate equipment and trained instructors lead to positive outcomes. Conversely, low theoretical mastery in Forensic Ballistics is attributed to a lack of qualified instructors despite available resources. School A excels in Forensic Toxicology and Chemistry due to aligned institutional components. These patterns indicate that a holistic educational approach maximizes competency, while deficiencies in any area can hinder understanding. Consistent evaluation of curricula, resources, and faculty development is essential for improving forensic science education to meet licensure and professional practice demands (Gabasa & Raqueño, 2021; Albina et al., 2021; Bautista et al., 2018).

## b. The Students Competency in Familiarization on Practical Application in Forensic Science.

Familiarization with the practical application of forensic science is essential in bridging theoretical knowledge and real-world investigative procedures. This study evaluated the competencies of criminology students from three schools across six forensic science domains—Forensic Photography, Personal Identification Techniques, Forensic Toxicology and Chemistry, Questioned Document Examination, Lie Detection Techniques, and Forensic Ballistics. In *Forensic Photography*, all schools achieved a "Very Competent" rating, though competency varied by instructional approach. School B's highest score (3.71) was attributed to its use of real-case simulations and interdisciplinary learning, consistent with Morelato et al. (2023), who emphasized the effectiveness of experiential learning. School A, using only traditional lectures, scored lowest (3.14), especially in accident reconstruction tasks, affirming Teixeira et al. (2023) who stressed the importance of hands-on projects in building scientific thinking. In *Personal Identification Techniques*, all schools showed high competency, but School A led (3.866) due to methods like simulation and repetition, despite none having instructors with specialized training. This approach mirrors the success of challenge-based learning at Tecnologico de Monterrey (Eraña-Rojas et al., 2019) and supports (Nilendu, 2024) on the value of experiential, evidence-based instruction. Schools like DLSU-Dasmariñas and Lyceum of the Philippines University serve as benchmarks with their strong integration of theory and practice in forensic education.

The assessment continued with *Forensic Toxicology and Chemistry*, where School A again led (WM = 3.42) due to advanced lab facilities and dynamic teaching methods. Schools B (2.59) and C (2.69) underperformed, mainly due to traditional instruction and lack of specialized faculty. These findings align with Almond (2023) and programs like those of Jefferson and CFSRE, which integrate internships and courtroom simulations to improve applied skills. Similarly, the University of Reading and Southern California University of Health Sciences (2025) show that research-led teaching and modern pedagogy enhance employability. In *Questioned Document Examination*, School B excelled (WM = 3.93) due to mixed methods and faculty expertise, while Schools A and C showed weaknesses due to lack of specialization, supporting Lagumen (n.d.) and P & G (2025) on the need for qualified instructors. In *Lie Detection Techniques*, School A performed best, with School B trailing due to traditional methods and limited troubleshooting instruction—highlighting the significance of examiner training as emphasized by Test (2024) and elearncollege.com (2024). Finally, in *Forensic Ballistics*, Schools A and B showed strong foundational skills, but all schools struggled with GSR and toolmark analysis, with only School B achieving high technical proficiency due to superior facilities. These gaps emphasize the critique of OBE's competitiveness over substance (Kennedy & Birch, 2020) and the need for consistent quality management in forensic education, as stressed by Heavey et al. (2023).

## Relationships Between Institutional Status and the Competency of Criminology Students.

A Chi-square test of independence was employed to analyze the correlation between institutional resources and student performance in areas such as forensic photography, personal identification techniques, and forensic toxicology.

Variable 1	Variable 2	Computed Value (X <sup>2</sup> )	mputed ValueCritical Value (from(X2)Chi – Square Value)		
Forensic Photography	Status of the Institution	38.25	12.592	Significant	
Personal identification Techniques	Status of the Institution	25.65	12.592	Significant	

Table 1. 1 Correlation between Familiarization in practical Competency and the Status of the Institution

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	Forensic chemistry and Toxicology	Status of the Institution	109.68	12.592	Highly S	lignificant	
	Forensic Questioned Document Examination	Status of the Institution	112.14	12.592	Highly S	ignificant	
	Lie Detection Techniques	Status of the Institution	14.84	12.592	Signi	ificant	
	Forensic ballistics	Status of the Institution	22.52	12.592	Signi	ificant	

The **practical competency** underscores a significant correlation between institutional status—specifically laboratory equipment, teaching methodologies, and instructor qualifications—and the practical application competencies of criminology students in forensic science, as confirmed through chi-square analysis. Well-equipped laboratories and highly trained instructors substantially boost students' ability to translate theoretical concepts into real-world forensic applications, reinforcing the importance of experiential learning and continuous faculty development. These findings align with Gabasa and Raqueño (2021), who emphasized the impact of institutional quality on board exam performance and academic outcomes. Moreover, international benchmarks such as the National Autonomous University of Mexico's forensic science program highlight the value of competency-based education, as also supported by Nilendu (2024) and Gallagher and Savage (2020) through Challenge-Based Learning frameworks. Consequently, Philippine HEIs and SUCs are urged to adopt a holistic, Outcome-Based Education (OBE) model that prioritizes resource adequacy and pedagogical innovation to produce graduates who are both theoretically knowledgeable and practically competent in forensic science.

Variable 1	Variable 2	Computed ValueCritical Value (from(X2)Chi – Square Value)		Interpretation	
Forensic Photography	Status of the Institution	35.33	12.592	Significant	
Personal Identification Techniques	Status of the Institution	16.26	12.592	Significant	
Forensic Chemistry and Toxicology	Status of the Institution	38.59	12.592	Significant	
Forensic Questioned Document Examination	Status of the Institution	77.26	12.592	Highly Significant	
Lie Detection Techniques	Status of the Institution	83.97	12.592	Highly Significant	
Forensic ballistics	Status of the Institution	17.32	12.592	Significant	

Table 1. 2 Correlation between Theoretical Competency and the Status of the Institution

The **theoretical competency** demonstrates a significant relationship between institutional factors—namely laboratory equipment, teaching methodology, and instructor qualifications—and the theoretical competency of criminology students in forensic science subjects, as confirmed through chi-square test results that exceeded the critical value of 12.592, particularly in Lie Detection Techniques and Questioned Document Examination. These findings suggest that investments in well-equipped laboratories, diverse pedagogical strategies, and faculty

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qualifications are crucial for fostering strong theoretical foundations. Aligning with Romanos (2022), who links educational access and public engagement to institutional support, and Lewis et al. (2020), who emphasizes the role of early exposure to practical learning in academic success, the study reinforces the value of Outcome-Based Education (OBE) in bridging academic preparation with real-world forensic demands. It also addresses a research gap noted in (Wagner et al., 2021), which highlights a lack of comprehensive study in core forensic disciplines, thereby supporting the call for improved educational delivery mechanisms. This study affirms the necessity for holistic institutional strategies to elevate theoretical competency and ensure that criminology graduates are well-equipped for professional forensic practice.

**The Significant Agreement Among the Ranks on the Competencies of Criminology Students.** This study assessed the agreement among three institutions—School A, School B, and School C—regarding the competencies of Criminology students in six forensic science areas, utilizing Kendall's Coefficient of Concordance (W) to measure the consistency of rankings related to laboratory equipment, instructor qualifications, and teaching methodologies

	School A			School B			School C			
Competency Area	Moderately Complied Laboratory <b>Equipment</b>	With specialized training, Instructors	Traditional Method Technique	Complied Laboratory <b>Equipment</b>	Without specialized training, Instructors	Mixed Method Technique	Moderately Complied Laboratory Equipment	Without specialized training, Instructors	Mixed Method Technique	Sums of Ranks
Forensic Photography	5		2		2			9		
Personal Identification Techniques	1			3		1			5	
Forensic Toxicology and Chemistry	6				6			6		18
Document Questioned Examination	2				1 5		5		8	
Lie Detection Technique	3			5		3		11		
Forensic Ballistics	4		4		4			12		
									Total	63

 Table 2

 Kendall's Coefficient of Concordance

The computed Kendall's W value of 0.619 indicates a moderate to strong level of agreement among the institutions, suggesting that they share a relatively consistent perspective on student competencies despite differences in resources. This consensus highlights shared strengths and areas for improvement in forensic education, providing a foundation for collaborative efforts to standardize practices and enhance educational quality across institutions, while also informing policymakers about the need for unified standards in forensic education to ensure consistent training for students. The findings of this study align with Naz et al. (2023), who emphasized the necessity for consistency in teaching content and pedagogical approaches within criminal justice education, advocating for instructional practices that meet students' evolving needs. Similarly, the results indicate that institutions in Albay, despite variations in resource allocation, share a common vision regarding competency expectations, reinforcing the call for standardization in education. This agreement on competency rankings reflects a harmony in pedagogical approaches, as highlighted by Kkienerm (n.d.), where traditional and mixed teaching methods yield comparable student outcomes, and underscores the importance of well-equipped laboratories for effective forensic practice, as noted by Nilendu (2024). Furthermore, the study suggests that collaborative methods and resource pooling among institutions could enhance educational practices and bridge competency gaps, resonating with Towler et al. (2023) and the broader competencies highlighted by Alos et al. (2023), which emphasize the importance of cultural adaptability and holistic readiness for professional practice in criminology graduates.



# Standard Outcome-Based Education Laboratory Manual in all areas of Forensic Science and proposed Action Plan

In the field of forensic science, a comprehensive educational framework is essential for equipping students with the necessary theoretical knowledge and practical skills. The Standard Outcome-Based Education (OBE) Laboratory Manual for Forensic Science aims to establish uniformity in forensic education across institutions, ensuring that aspiring professionals are well-prepared to meet industry demands.

The Standard Outcome-Based Education (OBE) Laboratory Manual for Forensic Science is designed to create a comprehensive framework that integrates theoretical knowledge with practical skills necessary for developing competent professionals in the field. This manual addresses the need for uniformity in forensic education across institutions, providing educators with a structured approach to teaching and assessment in critical areas such as forensic photography, personal identification techniques, forensic toxicology, questioned document examination, lie detection techniques, and forensic ballistics. By promoting student-centered learning and aligning with national and international standards, the manual includes essential components such as safety guidelines, detailed exercises, standardized documentation templates, and assessment rubrics, all aimed at fostering a structured and outcome-focused learning environment. The implementation of this initiative will involve forming a committee for needs assessment, drafting the manual, pilot testing, and organizing workshops for educators, ultimately enhancing the quality of forensic education and producing proficient practitioners.

**The proposed action plan** aims to align forensic science education with an Outcome-Based Education (OBE) framework, addressing significant gaps in laboratory equipment, faculty training, and instructional methods that currently hinder student competency. By focusing on structured interventions to improve institutional resources, instructor qualifications, and teaching methodologies, the plan seeks to prepare criminology students for successful careers in forensic science. Supporting this initiative, Guadamor (2020) emphasizes the importance of faculty development, while Orlanda-Ventayen (2020) highlights the need for rigorous academic policies to enhance board examination passing rates. Additionally, Albite (2020) underscores the significance of student-centered strategies for academic success, aligning with the OBE model's focus on measurable competencies. Overall, the action plan not only addresses existing educational gaps but also reinforces a systematic, competency-based approach to produce capable and competitive forensic practitioners, complementing broader strategies recommended in recent criminology research.

## Conclusions

The study identified disparities in laboratory equipment, instructor qualifications, and teaching methodologies across the schools. Some areas, particularly Forensic Photography and Lie Detection, were underresourced, which impacted students' hands-on learning opportunities. Student Competency demonstrated a higher competency in theoretical applications compared to practical skills, with School A showing the highest competency. The gap between theoretical and practical skills points to the need for more experiential learning opportunities. A significant relationship was found between the status of institutional resources (equipment, instructors, and teaching methods) and the competency of criminology students. Schools with better resources produced more competent students in both theoretical and practical aspects. There was moderate to strong agreement among the institutions on the competency levels of their students, indicating shared perspectives on the need for improvements in forensic science education. And the study concludes that the formulation of a standardized Outcome-Based Education Laboratory Manual and a comprehensive action plan is essential. These tools will help address the identified gaps in resources, teaching, and student competency, ultimately improving the quality of forensic science education.

## Recommendations

Finally, the researcher offers the following recommendations, addressed to key stakeholders such as the Commission on Higher Education (CHED), Philippine Association of Criminology Educators (PACE), Criminal Justice Education Council, and the respective academic institutions offering criminology programs, CHED and academic institutions should allocate funding to upgrade laboratory equipment in under-resourced areas, particularly in Forensic Photography and Lie Detection. Schools are encouraged to collaborate with local government units (LGUs), private donors, and the Department of Science and Technology (DOST) to secure the necessary resources that will enhance students' practical learning experiences. Academic institutions must integrate more experiential learning methods, such as simulations, role-playing, and laboratory exercises, into the criminology curriculum to strengthen students' practical skills and bridge the gap between theoretical knowledge and hands-on application. The Criminal

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Justice Education Council and CHED should invest in the professional development of criminology faculty by implementing continuous training programs, upgrading facilities, and adopting modern and innovative teaching methodologies that enhance student learning outcomes. CHED and the PCAP are encouraged to facilitate the establishment of a collaborative network among criminology schools to share best practices, organize joint training opportunities, and maximize the use of available resources. This inter-institutional network will promote collective growth in forensic science education. And CHED, in coordination with Criminology Educators, should spearhead the development and implementation of a standardized Outcome-Based Education (OBE) Laboratory Manual tailored specifically for forensic science instruction. This manual must include resource utilization guidelines, performance benchmarks, and competency-based assessment tools to ensure uniformity and academic excellence across institutions.

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