

MAKE-ROSCOPE: Accuracy and Practicability of Commercially-Available Keychain Microscope

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Abstract

Microscopy is vital in clinical education, including peripheral blood smears (PBS) analysis. This study evaluated the commercially available keychain microscope's accuracy, practicability, and effectiveness for potential use in educational settings. A mixed-methods research design was utilized, involving 50 licensed professionals (48 Registered Medical Technologists and 2 Pathologists) from the Municipal Health Units of Bacnotan, Balaoan, Bangar, City of San Fernando, Luna, San Gabriel, San Juan, Santol, and Santo Domingo, Ilocos Sur, as well as from La Union Medical Diagnostic Center and Hospital, Inc. (LUMED), the Philippine National Police (PNP) – Vigan City, and Metro Vigan Cooperative Hospital. Participants assessed the same PBS sample using both the commercially available keychain microscope and a traditional compound microscope. Results showed that while the keychain microscope was significantly less accurate in visualizing cell morphology ($p < 0.05$), it was rated highly for practicability, especially for ease of use and portability. However, effectiveness in terms of image contrast, sharpness, and structural visibility was considerably lower than that of the traditional microscope. The traditional compound microscope remains the preferred tool for precise cell analysis, which indicates there is a statistically significant difference in favor of the traditional compound microscope in terms of accuracy and effectiveness. Thus, while the keychain microscope serves as a low-cost, accessible option for introductory microscopy instruction, it is best used as a supplementary tool in school-based laboratory education.

Keywords: *keychain microscope; peripheral blood smear; accuracy; practicability; effectiveness*

1. Introduction

In biological and material sciences, microscopy is essential for students, researchers, and educators, as it allows them to envision structures at the microscopic level. Microscopy refers to the study and use of microscopes to observe objects and structures that are too small to be seen with the naked eye. Different types of microscopes, such as light microscopes, electron microscopes, and scanning electron microscopes, are used to explore various aspects of the microscopic world. The microscope has revolutionized numerous fields by revealing the cellular foundation of life, improving medical diagnostics, and enabling the study of microscopic life forms, plant tissues, and animal cells. It has accelerated progress in disciplines such as anatomy and histology, becoming a valuable tool for students, pathologists, and researchers, and has had a substantial impact on public health (Chanda, 2024).

The application of microscopy extends beyond research to include quality control, forensics, and environmental science. It permits researchers to identify structural weak points in materials, examine traces of evidence in forensic investigations, and detect hazardous microorganisms in air and water. According to Gellisch et al. (2025), microscopy is essential for identifying diseases, as it reveals cellular and tissue abnormalities that conventional approaches cannot detect. In educational settings, microscopy also serves as a bridge between theoretical knowledge and practical observation, allowing students to examine cells, tissues, and microscopic organisms closely. Its ability to illuminate the invisible world makes it essential for scientific discovery, technological advancement, and practical problem-solving across various disciplines. Thus, microscopy remains a cornerstone of modern science and a versatile technology with wide-ranging applications.

According to Excedr (2024), microscopy is a powerful scientific technique used to magnify small objects not visible to the naked eye, enabling scientists to study the intricate details of cells, tissues, and microorganisms. It is crucial in various fields, including biology, medicine, and material science. In medical research and diagnostics, microscopy is essential for identifying pathogens, examining tissue samples, and detecting cellular abnormalities that may indicate disease. This technique is particularly valuable in microbiology and pathology, where it aids in diagnosing infections and conditions such as cancer, as well as monitoring the effectiveness of treatments. The microscope's ability to reveal fine details contributes to advancements in various scientific research areas by providing clear, detailed images supporting both qualitative and quantitative analysis.

Most brands of traditional compound microscopes available on the market offer models at varying price points depending on their features and intended applications. Well-known manufacturers include Zeiss, Nikon, and Olympus. In this regard, Olympus manufactures the high-quality CX23 compound microscope, which is frequently utilized in laboratories and classrooms. In online shops like Microscope Central, the price of these microscopes, starting at ₱50,000 or more, is often expensive for many educational institutions. Zeiss and Nikon models, including the Zeiss Primostar and the Nikon Eclipse series, range in price from ₱80,000 to over ₱200,000, depending on the features. Hence, traditional compound microscopes are an expensive purchase, particularly for schools with limited resources (Microscope Central, 2024).

Commercially available keychain microscope kits, on the other hand, such as those offered on platforms like Shopee and TikTok shops, provide a more accessible and

inexpensive alternative for simple instructional purposes. Depending on the accessories and features of the kit, these kits usually cost between ₱199 and ₱2,000. For approximately ₱199 to ₱550, kits such as the Make-roscope by Jeremy de Leon, a low-cost, portable keychain microscope that can be mounted on the front camera of any smartphone or tablet and magnify organisms from 100x to 400x, are also offered. These kits are excellent for fieldwork and educational purposes because they are more portable than traditional compound microscopes and are easily accessible online (Mirielle, 2024).

Regarding accessibility and convenience, commercially available keychain microscope kits are typically simpler to transport and store. Unlike traditional compound microscopes, which need to be handled carefully and stored in designated areas due to their size, keychain microscopes can be utilized in various settings because of their smaller, lighter design. With over 12 million Filipino students using compound light microscopes annually, the Make-roscope offers an alternative. "Kits," which include prepared specimen slides and sample collection tools like pipettes, tweezers, tubes, and among others are introduced and integrated with the Make-roscope. At the time, the keychain microscope was being used by more than 8,500 Filipino teachers and students (Mirielle, 2024). Moreover, Make-roscope by Jeremy de Leon, available on Shopee and TikTok Shop, are utilized in this study to compare traditional compound microscope and commercially available keychain microscope kits regarding its accuracy, practicability, and effectiveness in educational settings.

The Make-roscope is a commercially available keychain microscope designed to attach to smartphones and tablets. Its small size allows students and educators to carry it as a keychain, promoting on-the-go learning. Unlike traditional compound microscopes, the Make-roscope offers accessibility and convenience. Its single-lens design is easily mounted on a device's front-facing camera, ensuring practical and ergonomic use. While its color options are not specified, it likely follows a minimalist, student-friendly aesthetic. Usability is a key feature, requiring minimal setup to achieve magnification. Although initial use presents a slight learning curve, users quickly adapt with magnification ranging from 265x to 400x—comparable to school-grade compound microscopes—the Make-roscope enables students to observe microscopic details of cells and tissues. Using smartphone cameras provides clear, high-resolution images and offers an affordable, portable alternative to traditional compound microscopes. This enables access to microscopy, supporting hands-on, experiential learning, particularly in resource-limited educational settings (Doringo, 2022).

Furthermore, commercially available keychain microscope kits offer a practical and affordable solution for integrating hands-on microscopy into classrooms. These kits include essential accessories and instructional materials, making them ideal for beginners and students seeking a more accessible way to explore life sciences. They are created and marketed for educational purposes, particularly for beginners and students, offering a cheaper and more accessible alternative while providing a hands-on experience with microscopy. Commercially available keychain microscope kits significantly enhance practical learning opportunities in resource-limited settings. These kits provide an accessible means for students to engage with hands-on scientific inquiry, bridging the gap between theoretical concepts and practical application in the classroom (UNESCO, 2024).

The key benefits of these commercially available keychain microscope kits are their user-friendly design, simple setup, and low cost, which make them especially useful for under-resourced institutions. Recent developments in optical technology enable these kits to provide high-quality imaging at a lower cost, making them appropriate for instructional purposes. However, compared to traditional compound microscopes, they are not always as precise or durable. Still, their true strength lies in affordability and ease of use, making them accessible to many students. These kits significantly impact classrooms worldwide, offering hands-on experiences that bring science to life and spark curiosity (Veeraraghavan et al., 2021).

According to UNESCO (2022), integrating portable and commercially available keychain microscope kits has been particularly beneficial in under-resourced regions with limited access to traditional laboratory equipment. A study conducted by Williams et al. (2020) highlights that these kits enhance students' understanding of microscopic concepts in countries where educational institutions face financial constraints, enabling students to gain practical experience without the high costs of standard laboratory equipment. Furthermore, technological advancements in microscope kit design, such as developing digital and mobile-compatible microscopes, broaden the accessibility of scientific tools in classrooms globally (Jones & Smith, 2020).

In settings with limited resources, low-cost smartphone-based microscopes offer significant advantages, as reviewed by Salido et al. (2022). These microscopes use clip-on lenses and smartphone cameras to increase magnification and image resolution, making them ideal for field research and education in budget-constrained environments. The integration of fluorescence imaging capabilities further enhances their utility for scientific exploration. Although they do not match the advanced features of traditional, high-cost microscopes, these affordable tools provide valuable microscopy experiences, especially for students and researchers in low-resource settings, fostering scientific engagement and education. One notable disadvantage of this setup is that the quality of the results heavily depends on the smartphone's camera. If the device has a low-resolution or outdated camera, it may produce blurry or unclear images, affecting the accuracy and reliability of the analysis.

In addition, the BioBus DIY microscope kit is designed as a hands-on material that allows students to design and create their own microscopes. The 3D-printed designs of the DIY microscope are customized to create a functional microscope, offering students a more accessible and affordable alternative to traditional compound microscope. The DIY microscope kit is developed as an educational tool, providing both high-quality and low-cost options. Over 230 students explore optics and advanced techniques through this kit, promoting cross-disciplinary learning by mimicking human vision. In areas with limited resources, the paper-based Foldscope microscope demonstrates its potential for diagnosing urinary tract and oral infections (BioBus, 2020).

Another study by Kaur et al. (2020) finds that the Foldscope can accurately identify microorganisms. Recent advancements in digital image processing, computer vision, and open hardware/software make microscopy more accessible and affordable, with tools like OpenCV, Scikit-learn, and Fiji/ImageJ driving innovation. Low-cost 3D printing and telecommunications enable telemicroscopy and mobile diagnostic devices, transforming microscopy into a more widely available and cost-effective solution for education and clinical use.

The field of microscopy has witnessed significant advancements in recent years, driven by the need for accessible and affordable solutions. Educators embrace DIY approaches, such as creating microscope camera adapters, to upgrade existing equipment and enhance student learning (Paderes & Paderes, 2022). Digital microscopes also gain popularity in educational settings, fostering collaborative learning environments and enabling students to capture high-resolution images for analysis (Dickerson et al., 2024).

In healthcare, researchers develop innovative smartphone-connected microscopes that can be used for telemedicine, particularly in remote or resource-limited areas. These devices often employ readily available components and provide a convenient way to share images and videos for diagnosis and consultation. Furthermore, advancements in 3D printing technology lead to the creation of low-cost microscopy platforms like the FPscope, which offers high-resolution imaging capabilities suitable for educational and research purposes (Zhang et al., 2021). These innovations collectively demonstrate the potential for affordable microscopy solutions to address challenges in various fields, including education, healthcare, and scientific research.

The OpenFlexure Microscope is an open-source, 3D-printed device that has gained international recognition for its affordability and accessibility in education and research. Developed to provide high-quality microscopy on a budget, this design integrates webcam optics or lab-grade objectives, making it ideal for low-resource settings (Knapper, 2021). It plays a role in democratizing access to microscopy in schools, particularly in underdeveloped regions, by significantly reducing the costs associated with traditional compound microscopes. Moreover, the OpenFlexure project facilitates advancements in precision imaging through its motorized control feature, which allows for accurate sample analysis in various scientific applications (Smith et al., 2020).

A pilot program in Tanzania utilizes the OpenFlexure Microscope in biology classrooms, demonstrating that the tool enhances students' hands-on learning experiences. By incorporating 3D printing and open-source technology, the OpenFlexure Microscope aligns with global efforts to improve science education through accessible and scalable innovations, making it an ideal solution for schools and laboratories facing resource constraints (O'Neill et al., 2021).

Schaefer et al. (2023) discussed the development of a low-cost smartphone fluorescence microscope designed for research, life science education, and STEM outreach. This innovative tool enhanced accessibility to microscopy by integrating affordable technology, making it ideal for educational settings. They emphasized that such devices could significantly improve hands-on learning experiences in biology and promote engagement in scientific inquiry among students. This aligned with the need for accessible laboratory equipment to facilitate practical education in resource-limited environments.

In the Philippines, proficiency in microscopy is a cornerstone of Medical Laboratory Science (MLS) education, as outlined in the Commission on Higher Education's (CHED) CMO No. 14 Series of 2006. This memorandum emphasized the importance of equipping students with the necessary skills to conduct detailed microscopic examinations, identify microorganisms, and utilize microscopy techniques in clinical diagnosis. These competencies were integral to the accuracy and reliability of

laboratory results, directly impacting patient care and clinical outcomes. Therefore, hands-on training in microscopy was a crucial component of MLS curricula, ensuring that graduates were proficient in performing diagnostic procedures and contributing effectively to healthcare delivery.

Commission on Higher Education Memorandum Order No. 6 (2017) focused on expanding the guidelines for the CHED Research Chair Award, clarifying eligibility and procedures for faculty and researchers in higher education institutions. It outlined the award's coverage, eligibility requirements for project leaders, and the nomination process. Moreover, CHED Memorandum Order No. 17 (2017) provided updated policies for the undergraduate programs in Medical Laboratory Science, emphasizing outcomes such as competency in various laboratory techniques, including proficiency in microscopy, to enhance clinical practice.

Make-roscope, a commercially available keychain microscope, was highlighted as innovative educational tools that enabled students to explore the microscopic world. These portable microscopes effectively magnified specimens, making science accessible and engaging. The initiative fostered curiosity and enhanced science education by integrating practical tools into students' daily lives (Habito, 2021).

Furthermore, Reyes et al. (2024) noted that technological advancements have increased the number of commercially available keychain microscope kits, making them beneficial for educational institutions to enhance experiential learning. However, these microscope kits raise questions about their suitability for more advanced academic contexts. Often used for recreational purposes, they allow individuals to explore microscopic images to feed their curiosity. Additionally, some use them in educational environments due to their affordability and ease of access. While these kits are mainly designed for introductory-level instruction, they do not always meet the accuracy and quality standards necessary for specialized programs. Nevertheless, it helps students observe fundamental slides, such as peripheral blood smears, under commercially available keychain microscope kits.

The Make-roscope, a commercially available keychain microscope created by Jeremy de Leon, efficiently addressed access and price hurdles in scientific education in developing countries like the Philippines. The Make-roscope was funded by the Technology Application and Promotion Institute (DOST-TAPI) under the Invention-Based Enterprise Development (IBED) Program, and it reached over 8,500 Filipino students and instructors, considerably improving their learning experiences (Lucero, 2024).

Moreover, the Invention-Based Enterprise Development (IBED) Program supported the introduction of Make-roscope to schools, organizations, and institutions in Luzon, Visayas, and Mindanao. Its value increased during the COVID-19 pandemic, as it allowed students to engage in hands-on microscopy despite the constraints of online learning, which mainly depended on videos and simulations (Bautista & Reyes, 2020). In addition to educational kits containing prepared slides and sample collection tools, the Make-roscope promotes active learning, which was shown to improve student engagement and academic outcomes (Pawar et al., 2021). Overall, the Make-roscope represented a significant improvement in inexpensive microscopy, empowering students and educators by making science education more accessible and engaging and transforming teaching approaches in various contexts (Rodríguez & Hernández, 2022).

The study by Calvo-Haro et al. (2021) explored the use of 3D printing for creating medical devices, including microscopes, at a university hospital. They demonstrated that 3D-printed microscopes could be produced cost-effectively and rapidly, offering a practical solution for diagnostic needs. The flexibility of the 3D printing process allowed for the customization of the microscope's design to meet specific laboratory requirements. This innovation aimed to improve access to diagnostic tools in resource-limited settings by reducing costs and reliance on traditional manufacturing and supply chains.

Integrating commercially available keychain microscope kits in educational settings, particularly for science, technology, engineering, and mathematics (STEM) education, gained attention. Accessible microscopy solutions, like the Make-roscope keychain, offered significant benefits for students, especially in resource-constrained environments. The portability and affordability of the kits made them an attractive option for schools aiming to enhance hands-on learning experiences, fostering curiosity and understanding in students. The Make-roscope kit exemplified how microscopy innovations addressed STEM education gaps, making practical laboratory experiences more inclusive and widespread. The role of practical laboratory experiences in science education was crucial for developing students' competencies and interest in STEM fields (Lucero, 2024).

This study aimed to evaluate the accuracy, practicability, and effectiveness of commercially available keychain microscope kits in school-based training laboratories, particularly for basic instructional activities such as peripheral blood smear (PBS) analysis. The study focused on evaluating the accuracy of each microscope in terms of the clarity in color, shape, and stain (Wright stain). Additionally, the study evaluated the practicability of commercially available keychain microscopes in educational settings by assessing ease of use, portability, and cost-effectiveness. Moreover, the study evaluated the level of effectiveness of each microscope in consideration of its contrast, sharpness, and structural visibility.

The results of this study were beneficial to the field of medical technology/medical laboratory science (MT/MLS) education, particularly for students' hands-on learning. If proven feasible, it offered a more affordable and convenient option for school-based laboratories without replacing traditional compound microscopes. Moreover, administrators could utilize the findings to make informed resource allocation decisions, addressing budget constraints while maintaining educational quality. This study generally fostered innovation in MLS education, bridging the gap between underfunded and well-funded institutions, and ensuring that students were better equipped for clinical work, benefiting the overall quality of education in the healthcare system.

This study did not attempt to replace traditional, high-quality microscopes used in clinical or diagnostic laboratories, as the comparison would have been distinctly inequitable and biased. Instead, it aimed to explore the feasibility and potential use of these microscope kits for educational and training purposes. Although it might not have been entirely applicable for the professional use of microscopes in hospitals or clinical settings, it can be useful for school-based training laboratories where traditional, high-quality microscopes were unavailable.

2. Objectives

This study aimed to evaluate the accuracy, practicability, and effectiveness of commercially-available keychain microscopes in assessing cell morphology, particularly in the context of peripheral blood smear (PBS) analysis in educational settings. Specifically, the study sought to address the following questions:

1. What is the level of accuracy in cell morphology assessment in both the control and experimental groups with respect to the clarity of cell morphology in terms of:
 - a. Color;
 - b. Shape; and
 - c. Stain (Wright Stain)?
2. What is the perceived level of practicability of commercially-available keychain microscope in educational settings in terms of:
 - a. Ease of use;
 - b. Portability; and
 - c. Cost-effectiveness?
3. What is the level of effectiveness of microscopes in educational settings in both control and experimental groups in terms of:
 - a. Contrast;
 - b. Sharpness; and
 - c. Structural Visibility?
4. Is there a significant difference between the grade of experimental group and control group when assessed according to:
 - a. Level of accuracy of cell morphology assessment; and
 - b. Level of effectiveness of microscopes?

3. Materials and methods

To effectively collect and analyze the necessary data for evaluating the accuracy, practicability, and effectiveness of the commercially available keychain microscope, the researchers utilized a combination of structured instruments aligned with the mixed-methods design of the study. Data were analyzed using descriptive statistics to interpret scores on accuracy, resolution, and practicability. The study employed a structured observation checklist and a 4-point Likert scale to measure the accuracy of the keychain microscope in visualizing peripheral blood smear (PBS) sample features such as color, shape, and stain (Wright Stain). For the assessment of effectiveness, a resolution test was utilized, focusing on contrast, sharpness, and structural visibility.

The perceived practicability of the microscope kits in educational settings was evaluated using a survey with items on ease of use, portability, and cost-effectiveness, with each item rated on a 4-point scale ranging from “Not Practical” to “Highly Practical.” To ensure the instrument’s relevance and rationality, it underwent validation by five expert professionals with extensive backgrounds in medical technology/medical laboratory science and demonstrated competency in microscopy. The instrument was pre-tested on thirty (30) registered medical technologists and pathologists working in various healthcare settings to identify ambiguities or areas requiring clarification, allowing for necessary modifications before the primary data collection phase.

Data Gathering Procedure

The data gathering procedure, as illustrated in Figure 1 page 11, was conducted systematically to ensure the accuracy and reliability of results while strictly adhering to ethical standards. Two groups were prepared: one using a commercially-available keychain microscope (experimental group) and the other using a traditional compound microscope (control group). To maintain consistency in assessment, only one peripheral blood smear (PBS) sample was prepared and presented to both groups. The study was anchored in fundamental ethical principles, including voluntary participation, the right to withdraw, anonymity, confidentiality, and non-maleficence. Participants were fully informed of the study's purpose, procedures, and any potential risks before data collection. Informed consent was obtained from each participant, ensuring that their involvement was voluntary and free from coercion.

Anonymity was preserved by ensuring that no personally identifiable information was collected or linked to responses. All data were treated with strict confidentiality and used solely for academic purposes. Access was restricted to the research team, and all records were securely stored to prevent unauthorized access or disclosure.

To uphold the principle of non-maleficence, the study was designed to avoid causing any form of physical, emotional, or psychological harm. All procedures were conducted professionally and sensitively, prioritizing the safety, dignity, and welfare of participants. Moreover, participants were reminded of their right to withdraw from the study at any point without penalty or the need to provide justification.

Prior to data collection, the research protocol underwent a formal review by the LORMA Colleges Research Ethics Committee (REC). The committee evaluated all aspects of the study—including its objectives, methodology, data protection strategies, and ethical safeguards—before issuing ethical clearance, thereby ensuring compliance with institutional and national research standards.

Following ethics approval, preliminary steps included sending formal communication to the research adviser, research statistician, and Dean for guidance and administrative approval. Participants were recruited through official invitation letters that clearly outlined the study's purpose, procedures, and ethical protections. Informed consent was reaffirmed before participation began.

As part of the preparation phase, the procurement of Make-roscope kits was carried out. These commercially-available keychain microscopes were purchased from the Shopee store jereMake at ₱549.00 per unit. The kits were chosen for their affordability, simplicity, and usability in resource-limited educational environments. Each kit included essential microscopy tools and was designed for smartphone integration, providing magnification ranging from 100x to 400x—suitable for observing cellular morphology in PBS analysis.

For specimen collection, a single third-year Medical Laboratory Science student served as the blood donor to ensure consistency across all test samples. The donor underwent a complete medical evaluation, including laboratory tests such as CBC, hemoglobin, hematocrit, and platelet count. Medical clearance was issued by a licensed physician. Under the supervision of a registered medical technologist (RMT), 5 mL of venous blood was drawn using sterile techniques. The donor provided informed

consent, and all ethical standards regarding specimen handling, anonymity, and voluntary participation were strictly observed.

Peripheral blood smears were prepared following standard laboratory protocols. Researchers used clean slides, Wright staining reagents, and maintained proper technique to ensure consistent sample quality. Slides were labeled, smeared, stained, and dried according to accepted procedures. Quality assurance was observed throughout, with oversight from a licensed RMT to ensure laboratory standards and internal validity.

During the microscopy phase, participants examined the same PBS sample using their assigned microscopes. With the keychain microscope, the slide was placed on the lens and viewed using a smartphone camera. With the compound microscope, the slide was placed on the stage and observed under low-power objective. Participants evaluated the clarity of the cell morphology in terms of color, shape, and stain quality. They then completed a structured survey assessing the usability, portability, and cost-effectiveness of the keychain microscope.

Additionally, a resolution test was conducted to evaluate contrast, sharpness, and structural visibility. Observational notes were recorded throughout the process to document participant behavior, challenges encountered, and any issues related to microscope usability. These qualitative observations supported and contextualized the survey data.

For data analysis, the study employed both descriptive and inferential statistics. Weighted means were computed to assess responses related to practicability and effectiveness. An independent t-test was used to determine if significant differences existed between the control and experimental groups regarding clarity and usability. All data were encoded and processed using Python and Microsoft Excel. Observational data were thematically analyzed to identify trends and patterns, enhancing the depth of interpretation.

This mixed-methods approach ensured that the study's findings were robust, valid, and aligned with its objectives, providing meaningful insights into the educational applicability of commercially-available keychain microscopes in resource-limited academic settings.

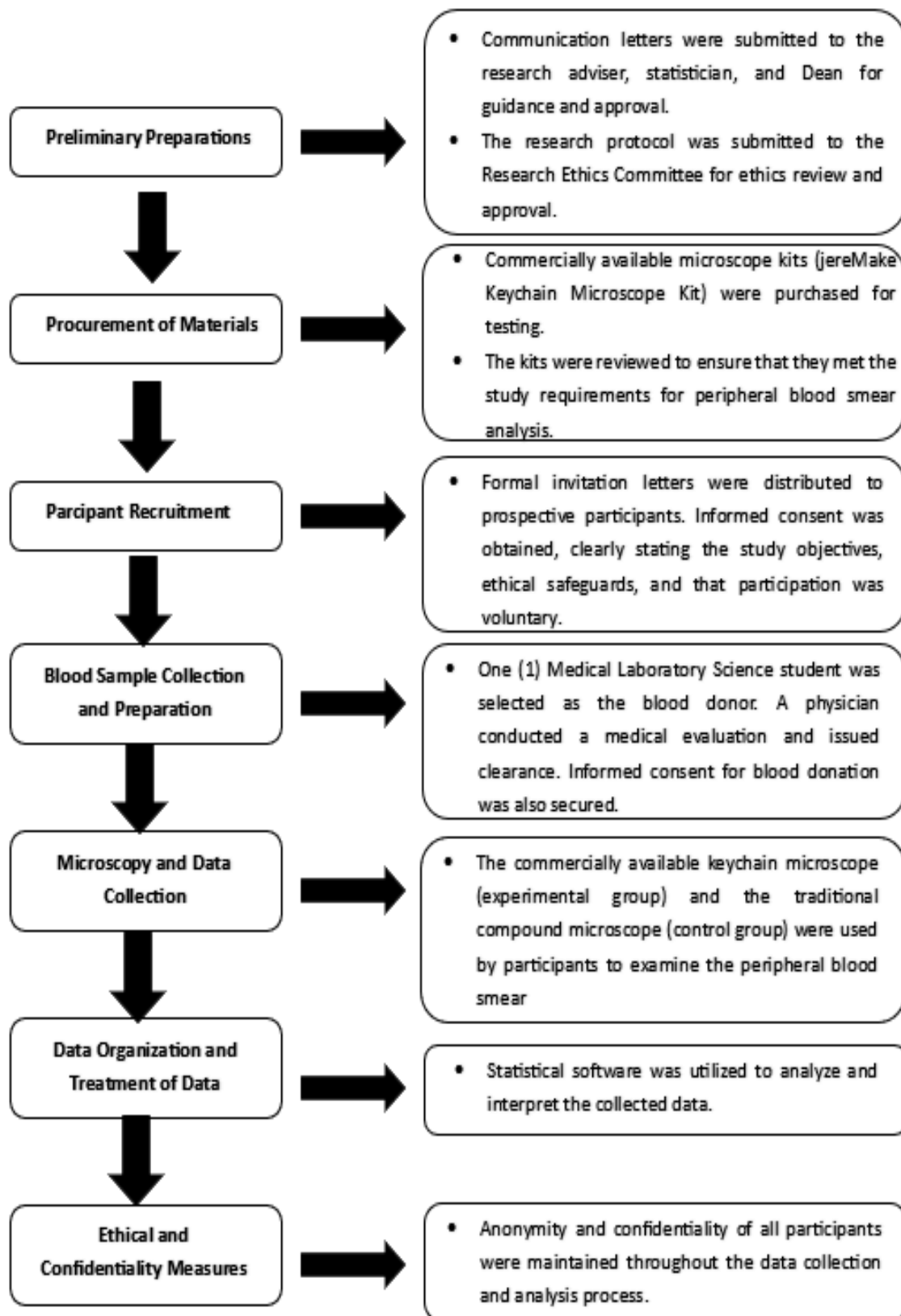


Figure 1 *The Data Gathering Procedure of the Study*

4. Results

Level of Accuracy of Cell Morphology Assessment in Terms of the Clarity of Cell Morphology

Table 1 Mean Score of the Level of Accuracy of Cell Morphology Assessment in Both Control and Experimental Groups

Group	Mean Score	Descriptive Equivalent	Interpretation
Experimental Group (Commercially available keychain microscope)	2.74	Moderately Clear and Accurate	Blood cells are visible. Shape, color, and stain are slightly distorted. Identification is possible with effort.
Control Group (Traditional compound microscope)	3.99	Highly Clear and Accurate	Blood cells are clear and accurately displayed with proper color, shape, and stain.

Legend: 3.26-4.00 - Highly clear and accurate, 2.51-3.25 - Moderately clear and accurate, 1.76-2.50 - Slightly clear and accurate, 1.00-1.75 - Not clear and accurate

Table 1 presented the mean scores obtained by the traditional compound microscope (control group) and the commercially available keychain microscope (experimental group) in assessing the clarity of cell morphology concerning color, shape, and stain (Wright stain). The control group achieved a mean score of 3.99, within the descriptive range of "Highly Clear and Accurate." In contrast, the experimental group recorded a mean score of 2.74, corresponding to a "Moderately Clear and Accurate" interpretation.

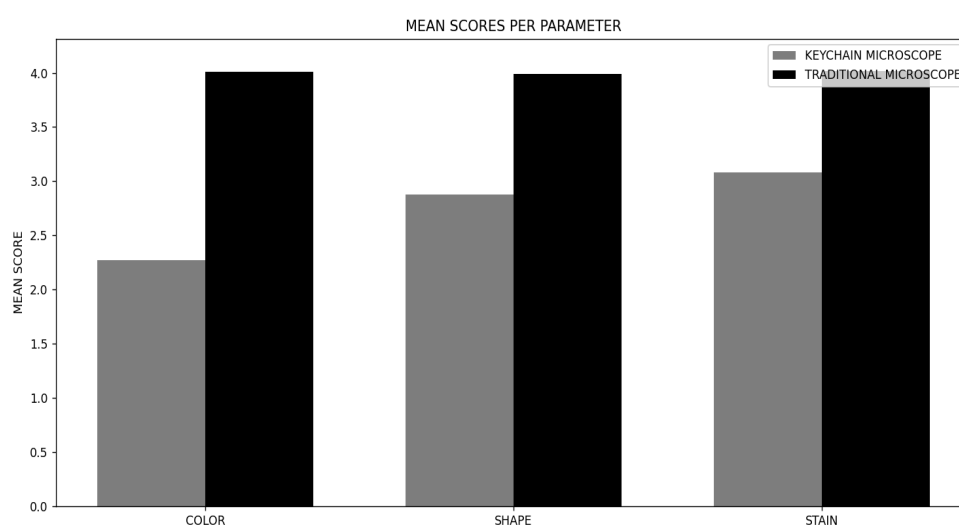


Figure 2 The Level of Accuracy of Cell Morphology Assessment in Both Control and Experimental Groups (Weighted Mean of Color, Shape, and Stain)

Table 2 T-Test Result of the Level of Accuracy of Cell Morphology Assessment in Both Control and Experimental Groups

Parameter	T-Statistic	P-Value
Color	-15.3162	<0.001 (p < 0.05)
Shape	-10.6250	<0.001 (p < 0.05)
Stain (Wright Stain)	-10.8300	<0.001 (p < 0.05)
TOTAL	-19.3411	<0.001 (p < 0.05)

Indicator: ($p < 0.05$) - there is a significant difference

To determine the statistical significance of the observed difference in accuracy between the two groups, an independent t-test was conducted. As shown in Table 2, the resulting T-statistic was -19.3411 , and the p-value was <0.001 , which was less than the 0.05 significance level. This indicates a statistically significant difference between the two groups' ability to assess cell morphology accurately in terms of color, shape, and stain (Wright stain).

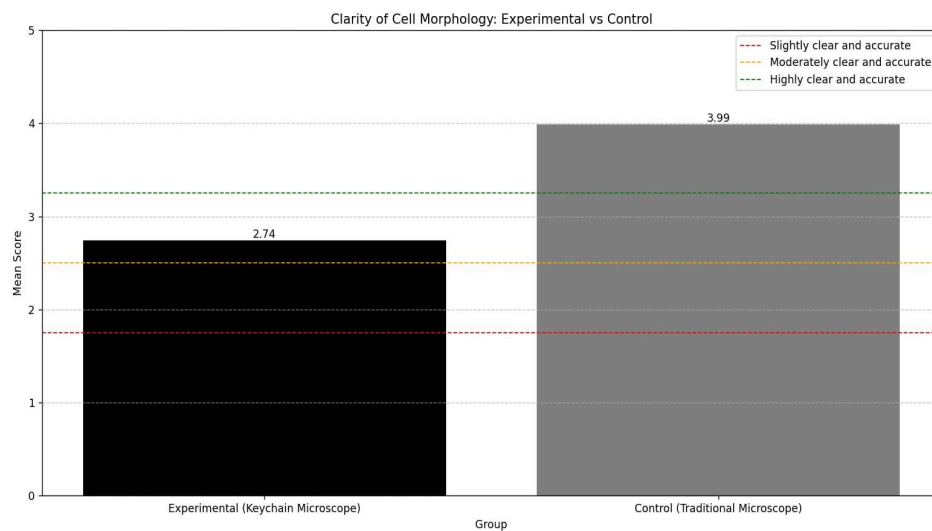


Figure 3 The Level of Accuracy of Cell Morphology Assessment in Both Control and Experimental Groups (Overall Weighted Mean)

Wan and Tao (2021) emphasized that although smartphone-based microscopes provide cost-effective and portable alternatives, they often fall short in delivering the high-resolution and optical fidelity required for detailed cellular evaluations, particularly in hematologic assessments. The lack of precision in reproducing critical features—such as nuclear contour, cytoplasmic granularity, and chromatin patterns—undermines the diagnostic reliability of such tools.

Similarly, Naqvi et al. (2020) further explained that while these portable devices are helpful for initial visualization and general orientation to microscopy, they are not suitable for rigorous academic or clinical use, especially in tasks requiring accurate differentiation of cell morphology. This is particularly relevant in the analysis of peripheral blood smears, where the ability to accurately interpret color intensity, cell shape, and stain distribution using Wright stain is crucial.

Perceived Level of Practicability of Commercially-Available Keychain Microscope in Educational Settings in Terms of: A) Ease of Use; B) Portability; and C) Cost-Effectiveness

Table 3 Mean Score of the Perceived Level of Practicability of Commercially Available Keychain Microscope

Practicability Indicator	Mean Score	Descriptive Equivalent	Interpretation
Ease of Use	3.26	Highly Practical	The microscope kit is easy to use, highly portable, and cost-effective, balancing price and performance.
Portability	3.50	Highly Practical	The microscope kit is easy to use, highly portable, and cost-effective, balancing price and performance.
Cost-effectiveness	3.18	Moderately Practical	The microscope kit is fairly easy to use and portable, and offers a fair balance of cost and performance.

Legend: 3.26-4.00 - Highly Practical, 2.51-3.25 - Moderately Practical, 1.76-2.50 - Slightly Practical, 1.00-1.75 - Not Practical

The results demonstrated that the keychain microscope achieved a mean score of 3.26 for ease of use, which is interpreted as “Highly Practical.” Participants indicated that the commercially available keychain microscope was simple to operate and required minimal instruction, making it suitable for general handling, especially those without prior microscopy experience. In terms of portability, the device received the highest mean score of 3.50, also categorized as “Highly Practical.” Its lightweight structure and compact design were cited as ideal for mobility, classroom demonstrations, and wide-field observation.

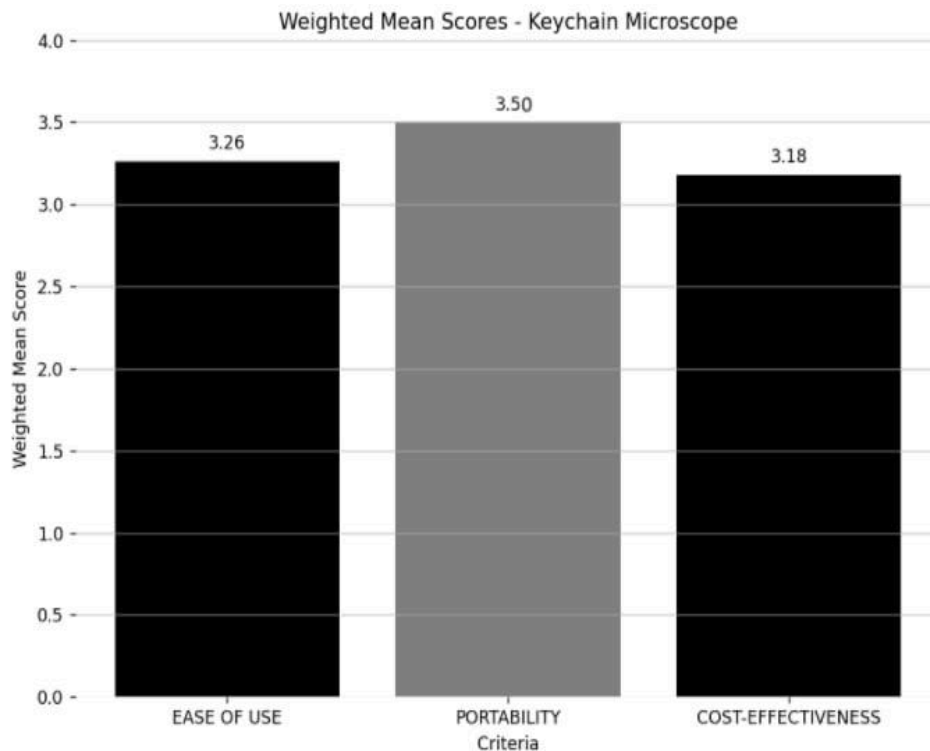


Figure 4 The Perceived Level of Practicability of Commercially Available Keychain Microscope (Weighted Mean of Ease of Use, Portability, and Cost-effectiveness)

These findings are supported by Pérez et al. (2022), who noted that the Foldscope—a similarly affordable, paper-based microscope—proved to be highly practical during the COVID-19 pandemic for remote and entry-level educational use. Its simplicity, portability, and low cost made it accessible to students in resource-constrained settings, allowing them to engage with microscopy despite limitations in laboratory access. However, Pérez et al. also emphasized that while the Foldscope enhanced exposure to basic microscopy, it was not suitable for high-resolution tasks or applications requiring diagnostic accuracy. This aligns with the study’s findings, where the commercially-available keychain microscope was rated highly in terms of ease of use and portability, making it an attractive tool for initial learning experiences and self-directed exploration.

Similarly, Naqvi et al. (2020) concluded that commercially-available microscopes, including smartphone-compatible models, provide foundational learning opportunities that help bridge theoretical knowledge and practical engagement. Their compact design and affordability were praised for supporting basic scientific inquiry in educational environments. However, they also cautioned that such devices lack the precision and durability required for rigorous laboratory science programs. In this context, the keychain microscope’s perceived practicability—particularly its ease of use, its lightweight and mobile design, and its affordability—makes it a suitable supplementary tool for introductory education, though not a replacement for traditional compound microscope in educational laboratory settings.

Level of Effectiveness of the Microscope in Educational Settings in Both the Control and Experimental Groups in Terms of: A) Contrast; B) Sharpness; and C) Structural Visibility

Table 4 Mean Score of the Level of Effectiveness of the Commercially available Keychain Microscope

Parameter	Mean Score	Descriptive Equivalent	Interpretation
Experimental Group (Commercially Available Keychain Microscope)	2.53	Average Performance	Acceptable level of contrast, sharpness, and structural visibility; details are discernible with some effort
Control Group (Traditional Compound Microscope)	4.00	High Performance	Excellent contrast, sharpness, and structural visibility; fine details are clearly visible and easily distinguishable

Legend: 3.26-4.00 - High Performance, 2.51-3.25 - Average Performance, 1.76-2.50 - Below Average, 1.00-1.75 - Poor Performance

As shown in Table 4, the traditional compound microscope obtained a mean score of 4.00, which falls within the descriptive range of “High Performance.” This indicates that the device consistently provided excellent contrast, sharpness, and structural visibility—features that enabled clear identification of cellular components under microscopy. In contrast, the commercially available keychain microscope achieved a mean score of 2.53, corresponding to “Average Performance.” While it allowed the observation of basic cellular features, details were discernible only with effort, likely due to limitations in magnification range, lens quality, and external lighting dependence.

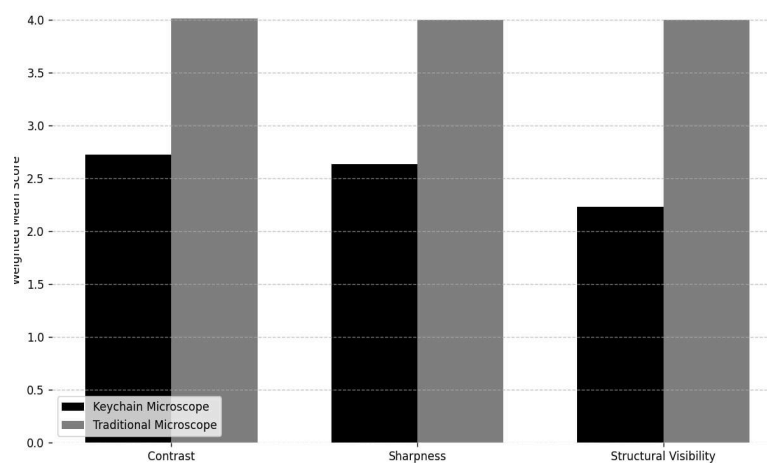


Figure 5 The Perceived Level of Effectiveness of Commercially Available Keychain Microscope (Overall Weighted Mean)

Table 5 T-Test result of the level of effectiveness of the commercially available keychain microscope

Parameter	T-Statistic	P-Value
Contrast	-15.7997	<0.001 (p < 0.05)
Sharpness	-19.8333	<0.001 (p < 0.05)
Structural Visibility	-16.4806	<0.001 (p < 0.05)
Total	-27.6642	<0.001 (p < 0.05)

Indicator: ($p < 0.05$) - there is a significant difference

To statistically validate the observed difference, an independent t-test was conducted, resulting in a T-statistic of -27.6642 and a p-value of <0.001 . Since the p-value is less than the standard 0.05 significance level, the results indicate a statistically significant difference in the level of effectiveness between the two groups. These findings confirm that the traditional compound microscope performed significantly higher than the commercially available keychain microscope in visualizing peripheral blood smears in terms of contrast, sharpness, and structural visibility.

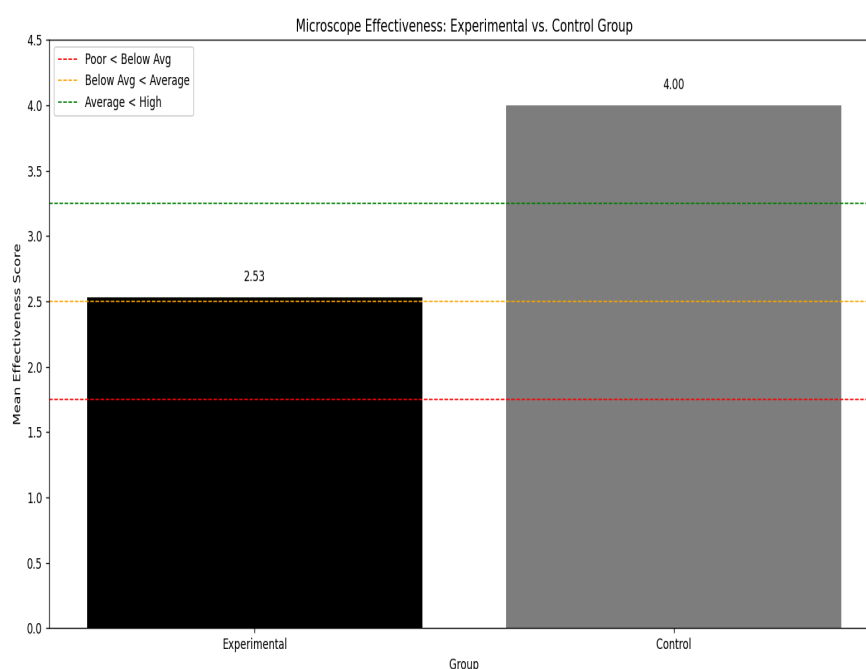


Figure 6 The Perceived Level of Effectiveness of Commercially Available Keychain Microscope (Weighted Mean of Contrast, Sharpness, Structural Visibility)

These findings are corroborated by existing literature. Schaefer et al. (2023) emphasized that while low-cost, portable microscopes have demonstrated significant value in educational outreach and introductory scientific demonstrations, they are generally limited in their capacity to produce high-resolution. Their optical limitations often result in reduced clarity, which impedes the accurate observation of fine cellular

details. This observation is consistent with the study's findings, wherein the commercially-available keychain microscope was rated lower in terms of contrast, sharpness, and structural visibility compared to the traditional compound microscope.

Similarly, Salido et al. (2022) highlighted that although smartphone-based microscopy devices provide a cost-effective means for promoting student engagement and experiential learning, their restricted optical performance limits their applicability in environments that require diagnostic precision. The effectiveness of the keychain microscope, as observed in this study, can be attributed to its inability to deliver consistent image sharpness and structural visibility. Thus, while the keychain microscope may serve as a practical tool for introductory instruction, it lacks the optical rigor necessary for more advanced educational laboratory applications.

The Significant Difference Between the Grade of Experimental Group and Control Group When Assessed According to Accuracy and Effectiveness

Table 6 T-Test result of the level of accuracy and effectiveness of the commercially available keychain microscope and traditional compound microscope

Parameter	T-Statistic	P-Value
Accuracy	-19.3411	<0.001 (p < 0.05)
Effectiveness	-27.6642	<0.001 (p < 0.05)

Indicator: (p < 0.05) - there is a significant difference

The results of the accuracy assessment showed a significant difference between the experimental group (commercially available keychain microscope) and the control group (traditional compound microscope). The experimental group had a mean score of 2.74, categorized as "Moderately Clear and Accurate," while the control group scored 3.99, categorized as "Highly Clear and Accurate." This indicates that the keychain microscope, while functional, lacks the resolution and clarity provided by the traditional microscope. The t-test confirmed a statistically significant difference with a p-value less than 0.001 ($p < 0.05$), highlighting the higher accuracy of the traditional compound microscope.

Gouveia et al. (2024) stated that alternative microscopes such as Foldoscope is an innovative educational tool that can identify basic histological structures bridging the gap between theories and histological practice. However, it is still incomparable to the traditional compound microscope due to its limitations in magnification, it lacks sharpness, and peripheral distortions may appear.

Brainmine (2022) highlighted the limitations of portable microscopes, particularly in resolution, making them less effective than traditional compound microscopes. Their lightweight design often leads to instability during high-magnification viewing, which compromises image quality. Moreover, the limited features and camera resolution of smartphones reduce their overall effectiveness. While portable microscopes offer a low-cost educational alternative that enhances accessibility, their use in precision-demanding settings remains limited. As such, their role is best suited for introductory learning environments rather than professional or diagnostic applications.

Table 7 Thematic Analysis of Identifying Trends Related to the Commercially Available Keychain Microscope

Theme	Codes Included	Quotes (from RMTs and Pathologists)	Interpretation
Usability Challenges	Minor focusing difficulty, mild clarity issues under LPO	<i>"Focusing takes a bit of patience."</i> <i>"Image quality is okay but not as sharp as compound scopes."</i> <i>"Takes some time to adjust for a clearer view."</i> <i>"Lighting needs a little tweaking sometimes."</i> <i>"Slight glare when used directly under bright light."</i>	Respondents noted minor usability issues such as focusing adjustments and lighting conditions, but these are manageable with practice.
Portability Advantage	Compact, lightweight, mobile use	<i>"I could carry it anywhere without a problem."</i> <i>"Its size makes it ideal for outreach programs."</i> <i>"It's convenient for quick teaching demos."</i> <i>"I can easily store it in my lab coat pocket."</i> <i>"Great for mobile health education."</i>	The microscope's small size and mobility are praised, especially for its utility in fieldwork, mobile learning, or non-traditional educational settings.
Learning Constraints	Limited detail under LPO, basic visualization only	<i>"Helpful for general cell shapes but not fine features."</i> <i>"Some structures are visible, others are faint."</i> <i>"Decent for early learning levels."</i> <i>"Good for introductory lessons."</i> <i>"Not as detailed, but still useful for basic microscopy."</i>	The Makecroscope works well for foundational education but may not be suitable for advanced morphological instruction under LPO.
Engagement Booster	Fun, engaging, motivates learners	<i>"Students may find it exciting to use."</i> <i>"It increased curiosity in microscopy."</i> <i>"A good introductory tool for beginners."</i> <i>"Adds variety to classroom demos."</i> <i>"Innovative and interactive experience."</i>	The novelty and simplicity of the microscope foster student interest, making it an engaging learning supplement.
Cost-Effectiveness	Affordable, resource-friendly	<i>"Very budget-friendly for schools."</i> <i>"A cost-efficient alternative to traditional scopes."</i> <i>"Affordable enough for students to own personally."</i> <i>"Perfect for institutions with limited funding."</i> <i>"Great value considering its portability and function."</i>	Respondents appreciated the affordability, making it suitable for personal and institutional educational use in resource-limited settings.

Table 7 shows the thematic analysis of the feedback from Registered Medical Technologists (RMTs) and Pathologists, revealing several perspectives on the educational use of the commercially available keychain microscope under Low Power Objective (LPO) conditions. While minor usability issues such as focusing and lighting adjustments were noted, these did not significantly hinder overall use. The microscope's portability was a major advantage, particularly for outreach programs and field-based education. Although it offers only basic visual clarity, it is suitable for activities that require wide-field observation. It proved effective in promoting hands-on learning and encouraging self-review, especially among students being introduced to microscopy. The commercially available keychain microscope was regarded as a practical and engaging tool for foundational exposure to microscopy—not as a replacement or supplementary device, but as a stand-alone aid for specific educational purposes.

Chou and Wang (2021) emphasized that while mobile microscopes are beneficial for educational purposes, they often require manual adjustments for focus and lighting. These adjustments, although initially challenging, are typical of portable designs and become easier with continued use. This observation aligns with participant feedback in the current study, where users encountered similar issues but gradually adapted through hands-on practice and repeated use, which in turn enhanced their confidence in handling the device.

Similarly, McDermott et al. (2021) highlighted the role of low-cost microscopy tools in expanding access to science education, particularly in settings with limited resources. Their findings support the use of affordable, portable devices to bridge gaps in laboratory instruction and provide foundational exposure to microscopy. In line with this, participants in the study identified the keychain microscope's lightweight and compact design as a major advantage, especially in field-based learning and outreach activities where transporting traditional equipment would be difficult.

Reyes et al. (2024) further noted that while the initial use of such devices may present a learning curve, continuous improvements based on user experiences and feedback contribute to greater usability over time. This adaptability helps ensure that tools like the keychain microscope remain relevant and effective for hands-on learning, self-guided exploration, and early-stage scientific engagement, particularly in under-resourced or informal educational settings.

5. Discussion

This study was conducted in various diagnostic and health institutions within the First Congressional District of the Province of La Union and parts of Ilocos Sur. Specifically, data were gathered from the Municipal Health Units (MHUs) of Bacnotan, Balaoan, Bangar, City of San Fernando, Luna, San Gabriel, San Juan, Santol, and Santo Domingo, Ilocos Sur. Additional sites included the La Union Medical Diagnostic Center and Hospital, Inc. (LUMED), the Philippine National Police (PNP) – Vigan City, and the Metro Vigan Cooperative Hospital. Employing a mixed-methods research design, the study evaluated the accuracy, practicability, and effectiveness of commercially-available keychain microscope kits in peripheral blood smear (PBS) analysis. A total of 50 licensed medical professionals, consisting of 48 Registered

Medical Technologists and 2 Pathologists, participated in the study through stratified sampling.

With respect to accuracy, the traditional compound microscope (control group) produced a higher mean score of 3.99, interpreted as "Highly Clear and Accurate." In comparison, the commercially-available keychain microscope (experimental group) produced a mean score of 2.74, interpreted as "Moderately Clear and Accurate." An independent sample t-test yielded a T-statistic of -19.3411 with a p-value less than 0.05, indicating a statistically significant difference between the two groups in terms of the accurate visualization of cellular morphology—specifically in the shape, color, and Wright staining of blood cells.

In terms of practicability, the commercially-available keychain microscope kits received favorable ratings. The participants rated ease of use with a mean of 3.26 and portability with a mean of 3.50, both interpreted as "Highly Practical." Cost-effectiveness was rated at 3.18, which fell under the interpretation of "Moderately Practical." These findings suggest that while the keychain microscope may lack precision, it provides notable advantages in terms of usability and accessibility.

Regarding effectiveness, the assessment focused on three key criteria: contrast, sharpness, and structural visibility of cell morphology. The results indicated that the commercially-available keychain microscope kits rated lower than the traditional compound microscope across all three parameters. The traditional compound microscope consistently provided more precise and distinguishable visualization of fine cellular details. In contrast, the commercially-available keychain microscope kits yielded reduced visual quality that required additional effort for interpretation.

These findings confirm that there is a significant difference between the experimental and control groups in both accuracy and effectiveness. The commercially-available keychain microscope kits are not recommended for use in core courses of the Medical Laboratory Science program or in clinical diagnostic procedures. Instead, they may be best suited for wide-view introductory exposure, basic familiarization with microscopy, or personal self-review purposes, especially in informal or resource-constrained educational contexts. Their use should be restricted to non-critical learning activities where high-resolution cellular detail is not required.

6. Conclusion

Based on the above findings, the researchers would like to articulate the following conclusions:

1. The traditional compound microscope obtained a higher mean score of 3.99, interpreted as Highly Clear and Accurate. In contrast, the commercially available keychain microscope received a mean score of 2.74, interpreted as Moderately Clear and Accurate. The results of the independent t-test revealed a statistically significant difference between the two groups ($p < 0.05$), indicating that the keychain microscope lacks the necessary resolution and magnification to accurately assess cell morphology, particularly in color, shape, and stain (Wright stain).
2. The keychain microscope received favorable ratings across three parameters: ease of use (mean = 3.26), portability (mean = 3.50), and cost-effectiveness (mean = 3.18). The first two parameters were interpreted as Highly Practical, while cost-effectiveness was interpreted as Moderately Practical. These results

suggest that while the device is limited in precision, it is considered user-friendly, convenient, and accessible.

3. The effectiveness of commercially available keychain microscope kits is limited in terms of resolution, specifically in contrast, sharpness, and structural visibility. When compared to the traditional compound microscope, the commercially available keychain microscope scored lower across all resolution indicators. This limitation implies that while general cell features may be observed, fine details required for morphological interpretation are not easily distinguishable. Thus, the keychain microscope's utility is best confined to activities where high-definition clarity is not essential, such as introductory demonstrations in cellular observation.
4. There was a statistically significant difference between the grades of the control group (traditional compound microscope) and the experimental group (keychain microscope) in terms of both accuracy and effectiveness. The traditional compound microscope consistently outperformed the keychain microscope across all evaluation parameters. Due to its significantly lower performance, the keychain microscope is not suitable as a supplementary instructional tool in core Medical Laboratory Science (MLS) courses that require precise morphological assessment. However, its practicality, affordability, and ease of use suggest that it may still serve a limited role for individual self-review, general conceptual reinforcement, and early-stage microscopy exposure—particularly in non-clinical or informal educational settings where diagnostic precision is not required.

7. Acknowledgements

First and foremost, the researchers express their deepest gratitude to God Almighty for His divine guidance, wisdom, and strength throughout the course of this study.

Sincere appreciation is extended to their adviser and instructor, Mark Ericson B. Baladad, MMPHA, RMT, for his continuous support, expert guidance, and encouragement, all of which were vital to the completion of this research.

The researchers also wish to acknowledge the valuable contributions of the members of the research panel: Dean Josephine C. Milan, RMT, MSMT; Jose Enrico M. Sumaya, RMT; and Jerome P. Vera, LPT. Their insightful feedback, recommendations, and time devoted to reviewing the study are deeply appreciated.

Gratitude is further extended to the statisticians—PLT. Benito T. Ponce Jr.; Dr. Aldrin Galvez, LPT; Engr. Shekiro R. Raposas, MTS; Dr. Shari Maro R. Raposas, LPT; and Engr. Lou Benedic C. Valle, MA-Math—for their expertise and support in the statistical analysis of the data.

The researchers are also thankful to the institutions that permitted the conduct of this study: the Municipal Health Units (MHUs) within the First Congressional District of La Union and Santo Domingo, Ilocos Sur; the La Union Medical Diagnostic Center and Hospital, Inc. (LUMED); the Philippine National Police (PNP) – Vigan City, Ilocos Sur; and the Metro Vigan Cooperative Hospital. Their cooperation played a crucial role in the realization of this research.

Lastly, the researchers extend their heartfelt appreciation to all the participants, especially those involved in the validity and reliability testing, for their time and willingness to contribute to the success of this study.

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9. Appendices

APPENDIX A

Letter of Intent to the Faculty Adviser



LORMA COLLEGE OF MEDICAL LABORATORY SCIENCE
Cariatan, City of San Fernando, La Union, Philippines, 2500
Facebook: @LormaCMLS | E-mail: cmcls@lorma.edu



September 1, 2024

MARK ERICSON B. BALADAD, MMPHA, RMT
Instructor
LORMA College of Medical Laboratory Science
City of San Fernando, La Union 2500

Re: Letter to the Research Adviser

Warm greetings of peace and health!

The undersigned BMLS third year students are interested to conduct a public health research entitled "Exploring the Laboratory Practicability and Utilization of Commercially-Available Microscope Kits" This is in partial fulfillment of the requirements for the course MRESEARCH1: Introduction to Medical Laboratory Science Research 1.

On this regard, we are humbly requesting your service as our Research Adviser for our study entitled "Exploring the Laboratory Practicability and Utilization of Commercially-Available Microscope Kits." We believe that your knowledge, expertise, and valuable insights will help us accomplish this endeavor successfully.

This research aims to investigate the practical applicability and effectiveness of commercially available microscope kits in laboratory settings. Our study is designed to assess how these kits perform in terms of accuracy, usability, and reliability. By systematically evaluating these factors, we seek to provide a thorough analysis that can guide users in selecting the most appropriate microscope kits for their needs and improve laboratory practices. The findings of this research will be crucial in determining the practical value of these kits and identifying any potential limitations. Our results may lead to recommendations for users and manufacturers, helping to enhance the quality of laboratory work and educational experiences. Additionally, our study aims to offer insights that could inform future developments in microscope technology and its application in various settings.

Your expertise would not only help us refine our research questions and methodology but also ensure that our findings are scientifically sound, credible, and impactful.

Should there be any further questions, concerns, or clarifications, please do not hesitate to reach our lead research proponent:

Name: Irish Nicole C. Ponce (BMLS III-1)
Phone number: 09926938108
E-mail: irishnicole.ponce@lorma.edu

We hope that you will be able to consider our request.

Thank you very much and God bless!

Respectfully yours,


JEANNE PRINCESS D. AQUINO


ANGEL LEAH V. COMILANG


MICHAELA LUISA A. FLORDELIS


IRISH NICOLE C. PONCE


APRIL JOY L. VILLANUEVA

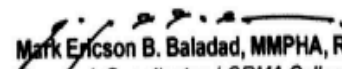

VENICE JANE M. TALAVERA

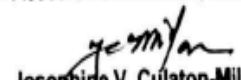
Student Researchers



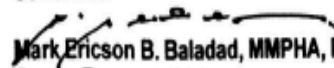
Noted by:


Mark Ericson B. Baladad, MMPHA, RMT
Instructor, Research Lecture and Laboratory


Mark Ericson B. Baladad, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science


Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science

Conformed:


Mark Ericson B. Baladad, MMPHA, RMT
Faculty Research Adviser
Date: **9/13/2024**

APPENDIX B

Letter of Intent to the Dean to Conduct a Study



LORMA COLLEGE OF MEDICAL LABORATORY SCIENCE
Carlatan, City of San Fernando, La Union, Philippines, 2500
Facebook: @LormaCMLS | E-mail: cmls@lorma.edu



March 18, 2025

Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science
Lorma Colleges

Subject: Request for Approval to Conduct Research Experimentation

Dear Dean Milan,

Greetings with a LORMA smile!

We, the undersigned third-year Bachelor of Science in Medical Laboratory Science students of Lorma Colleges, humbly write to request your approval to conduct the research experimentation for our study entitled: "Microscope: Accuracy and Practicability of Commercially Available Keychain Microscopes."

This study aims to evaluate the capability of commercially available keychain microscopes in assessing cell morphology—particularly in the context of peripheral blood smear (PBS) analysis—in comparison to standard laboratory microscopes. Through this research, we seek to explore the practicality of low-cost optical tools in educational settings, especially for students in resource-limited environments.

Our experimentation will involve a controlled comparison of PBS slides using both conventional and keychain microscopes, with proper safety and ethical considerations in place. We also intend to consult with our instructors and follow all institutional guidelines throughout the process.

We would be truly grateful for your support and permission to proceed with the implementation of this study as part of our academic and professional growth.

Thank you very much for your time and favorable consideration. We remain committed to upholding the values and standards of the College of Medical Laboratory Science.

Yours respectfully,


JEANNIE PRINCESS D. AQUINO


ANGELIAH V. COMBING


MICHAELA LUISA A. FLORDEUS


TRISHELLE E. RONCE


APRIL JOY VILLANUEVA


VENICE JANE M. TALAVERA

Noted by:


Mark Ericson B. Baladad, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science


Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science

APPENDIX C

Letters of Communication to the Target Samples



LORMA COLLEGE OF MEDICAL LABORATORY SCIENCE
Carlatan, City of San Fernando, La Union, Philippines, 2500
Facebook: @LormaCMLS | E-mail: cmcls@lorma.edu.ph



March 24, 2025

PLCOL Reynaldo Mendoza
Chief of Police
Vigan Police Station

Greetings with a LORMA smile!

We, the undersigned third-year students from the LORMA - College of Medical Laboratory Science, are currently conducting a research study entitled **"Microscope: Accuracy and Practicability of Commercially Available Keychain Microscopes."** This study is part of our academic requirements and aims to evaluate the accuracy and practicality of commercially available microscopes in educational settings, specifically in analyzing Peripheral Blood Smears stained with Wright stain. Our objective is to assess their potential as portable alternatives to traditional microscopes, thereby enhancing laboratory education.

As part of our research process, we plan to conduct our study in your institution by visiting your clinical laboratory to perform on-site evaluations and data collection. We are humbly seeking your permission and support to allow us access to your facility for the purpose of assessing the microscopes in use and gathering insights from Registered Medical Technologists (RMTs) and Pathologists.

To ensure the credibility of our research, we kindly request the participation of your institution's Registered Medical Technologists (RMTs) and Pathologists who meet the following criteria:

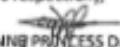
- Hold valid licenses as Registered Medical Technologists (RMTs) and Pathologists.
- Have a minimum of one year of practical experience focused on PBS using traditional microscopy.

Rest assured that all collected data will be treated with the utmost confidentiality and used solely for research purposes. We are committed to upholding ethical research principles, ensuring that participants' rights are protected, and maintaining the highest standards of data privacy. If you have any questions or require further clarification, please feel free to contact the lead proponent:

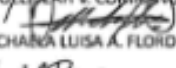
Name: Irish Nicole C. Ponce (BMLS III-1)
Phone number: 09926938108
E-mail: irishnicole.ponce@lorma.edu.ph

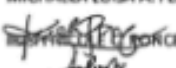
We aim to complete the data gathering by **March 31, 2025**. Rest assured that all collected data will be treated with the utmost confidentiality and used solely for research purposes. We are committed to upholding ethical research principles, ensuring that participants' rights are protected, and maintaining the highest standards of data privacy. Thank you, and may your institution continue to be blessed with success.

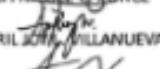
Yours respectfully,


JEANNIE PRINCESS D. AQUINO


ANGEL LEAH V. COMISING

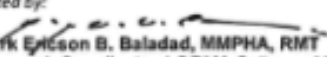

MICHANA LUISA A. FLORDELES


IRISH NICOLE C. PONCE


APRIL SOFIA VILLANUEVA


VENICE JANE M. TALAVERA

Noted by:


Mark Erlson B. Baladad, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science


Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science

Conformed:



March 24, 2025

PLCOL Reynaldo Mendoza
Chief of Police
Vigan Police Station

Greetings with a LORMA smile!

We, the undersigned third-year students from the LORMA - College of Medical Laboratory Science, are currently conducting a research study entitled **"Macroscopic: Accuracy and Practicability of Commercially Available Keychain Microscopes."** This study is part of our academic requirements and aims to evaluate the accuracy and practicality of commercially available microscopes in educational settings, specifically in analyzing Peripheral Blood Smears stained with Wright stain. Our objective is to assess their potential as portable alternatives to traditional microscopes, thereby enhancing laboratory education.

As part of our research process, we plan to conduct our study in your institution by visiting your clinical laboratory to perform on-site evaluations and data collection. We are humbly seeking your permission and support to allow us access to your facility for the purpose of assessing the microscopes in use and gathering insights from Registered Medical Technologists (RMTs) and Pathologists.

To ensure the credibility of our research, we kindly request the participation of your institution's Registered Medical Technologists (RMTs) and Pathologists who meet the following criteria:

- Hold valid licenses as Registered Medical Technologists (RMTs) and Pathologists.
- Have a minimum of one year of practical experience focused on PBS using traditional microscopy.

Rest assured that all collected data will be treated with the utmost confidentiality and used solely for research purposes. We are committed to upholding ethical research principles, ensuring that participants' rights are protected, and maintaining the highest standards of data privacy. If you have any questions or require further clarification, please feel free to contact the lead proponent:

Name: Irish Nicole C. Ponce (BMLS III-1)
Phone number: 09926938108
E-mail: irishnicole.ponce@lorma.edu

We aim to complete the data gathering by **March 31, 2025**. Rest assured that all collected data will be treated with the utmost confidentiality and used solely for research purposes. We are committed to upholding ethical research principles, ensuring that participants' rights are protected, and maintaining the highest standards of data privacy. Thank you, and may your institution continue to be blessed with success.

Yours respectfully,

JEANNIE PRINCESS D. AQUINO

ANGELINA V. COMBING

MICHAELA LUISA A. FLORDELES

BERNICE L. PONCE

APRIL JOY VILLANUEVA

VENICE JANE M. TALAVERA

Noted by:

Mark Ericson B. Baladad, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science

Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science

Conformed:

--



March 21, 2025

To Whom It May Concern

Greetings with a LORMA smile!

We, the undersigned third-year students from the LORMA - College of Medical Laboratory Science, are currently conducting a research study entitled **"Makecroscope: Accuracy and Practicability of Commercially Available Keychain Microscopes."** This study is part of our academic requirements and aims to evaluate the accuracy and practicality of commercially available microscopes in educational settings, specifically in analyzing Peripheral Blood Smears stained with Wright stain. Our objective is to assess their potential as portable alternatives to traditional microscopes, thereby enhancing laboratory education.

As part of our research process, we plan to conduct our study in your institution by visiting your clinical laboratory to perform on-site evaluations and data collection. We are humbly seeking your permission and support to allow us access to your facility for the purpose of assessing the microscopes in use and gathering insights from Registered Medical Technologists (RMTs) and Pathologists.

To ensure the credibility of our research, we kindly request the participation of your institution's Registered Medical Technologists (RMTs) and Pathologists who meet the following criteria:

- Hold valid licenses as Registered Medical Technologists (RMTs) and Pathologists.
- Have a minimum of one year of practical experience focused on PBS using traditional microscopy.

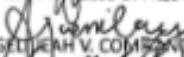
Rest assured that all collected data will be treated with the utmost confidentiality and used solely for research purposes. We are committed to upholding ethical research principles, ensuring that participants' rights are protected, and maintaining the highest standards of data privacy. If you have any questions or require further clarification, please feel free to contact the lead proponent:

Name: Irish Nicole C. Ponce (BMLS III-1)
Phone number: 09928938108
E-mail: irishnicole.ponce@lorma.edu

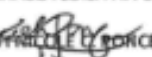
We aim to complete the data gathering by **March 31, 2025**. Rest assured that all collected data will be treated with the utmost confidentiality and used solely for research purposes. We are committed to upholding ethical research principles, ensuring that participants' rights are protected, and maintaining the highest standards of data privacy. Thank you, and may your institution continue to be blessed with success.

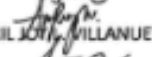
Yours respectfully,


JEANNIE PRINCESS D. AQUINO


ANGEL JEAN V. COMRANG

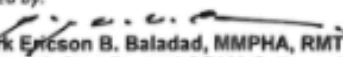

MICHAELA LUISA A. FLORDEUS

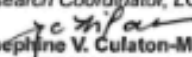

IRISH NICOLE C. PONCE


APRIL JOY VILLANUEVA


VENICE JANE M. YALAVERA

Noted by:


Mark Ericson B. Baladad, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science


Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science

Conformed:



March 24, 2025

To Whom It May Concern

Greetings with a LORMA smile!

We, the undersigned third-year students from the LORMA - College of Medical Laboratory Science, are currently conducting a research study entitled **"Makecroscope: Accuracy and Practicability of Commercially Available Keychain Microscopes."** This study is part of our academic requirements and aims to evaluate the accuracy and practicality of commercially available microscopes in educational settings, specifically in analyzing Peripheral Blood Smears stained with Wright stain. Our objective is to assess their potential as portable alternatives to traditional microscopes, thereby enhancing laboratory education.

As part of our research process, we plan to conduct our study in your institution by visiting your clinical laboratory to perform on-site evaluations and data collection. We are humbly seeking your permission and support to allow us access to your facility for the purpose of assessing the microscopes in use and gathering insights from Registered Medical Technologists (RMTs) and Pathologists.

To ensure the credibility of our research, we kindly request the participation of your institution's Registered Medical Technologists (RMTs) and Pathologists who meet the following criteria:

- Hold valid licenses as Registered Medical Technologists (RMTs) and Pathologists.
- Have a minimum of one year of practical experience focused on PBS using traditional microscopy.

Rest assured that all collected data will be treated with the utmost confidentiality and used solely for research purposes. We are committed to upholding ethical research principles, ensuring that participants' rights are protected, and maintaining the highest standards of data privacy. If you have any questions or require further clarification, please feel free to contact the lead proponent:

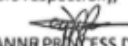
Name: Irish Nicole C. Ponce (BMLS III-1)

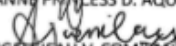
Phone number: 09926938108

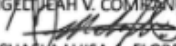
E-mail: irishnicole.ponce@lorma.edu

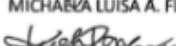
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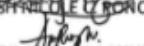
Yours respectfully,


JEANNINE PRINCESS D. AQUINO


ANGEL LEAH V. COMIZON

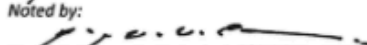

MICHARRA LUISA A. FLORDELIS


IRISH NICOLE C. PONCE


APRIL JOY VILLANUEVA


VENICE JANE M. YALAVERA

Noted by:


Mark Ericson B. Baladad, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science


Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science

Conformed:

--



March 18, 2025

To Whom It May Concern,

Greetings with a LORMA smile!

We, the undersigned third-year students from the LORMA - College of Medical Laboratory Science, are currently conducting a research study entitled "Microscope: Accuracy and Practicability of Commercially Available Keychain Microscopes." This study is part of our academic requirements and aims to evaluate the accuracy and practicality of commercially available microscopes in educational settings, specifically in analyzing Peripheral Blood Smears stained with Wright stain. Our objective is to assess their potential as portable alternatives to traditional microscopes, thereby enhancing laboratory education.

As part of our research process, we plan to conduct our study in your municipality by visiting your clinical laboratory to perform on-site evaluations and data collection. We are humbly seeking your permission and support to allow us access to your facility for the purpose of assessing the microscopes in use and gathering insights from Registered Medical Technologists (RMTs) and Pathologists.

To ensure the credibility of our research, we kindly request the participation of your institution's Registered Medical Technologists (RMTs) and Pathologists who meet the following criteria:

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- Have a minimum of one year of practical experience focused on PBS using traditional microscopy.

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Name: Irish Nicole C. Ponce (BMLS III-1)
Phone number: 09926938108
E-mail: irishnicole.ponce@lorma.edu

We aim to complete the data gathering by March 31, 2025. Rest assured that all collected data will be treated with the utmost confidentiality and used solely for research purposes. We are committed to upholding ethical research principles, ensuring that participants' rights are protected, and maintaining the highest standards of data privacy. Thank you, and may your institution continue to be blessed with success.

Yours respectfully,

JEANNINE PRINCESS D. AQUINO

ANGEL LEAH V. COMBARINO

MICHAELA LUISA A. FLORDEUS

IRISH NICOLE C. PONCE

APRIL JOY VILLANUEVA

VENICE JANE M. TALAVERA

Noted by:

Mark Ericson B. Baladad, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science

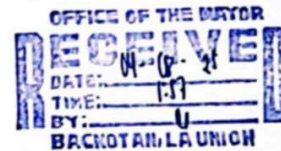
Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science

Conformed:



April 8, 2025

HON. DIVINA C. FONTANILLA
Municipal Mayor
Bacnotan, La Union



Greetings with a LORMA smile!

We, the undersigned third-year students from the LORMA - College of Medical Laboratory Science, are currently conducting a research study entitled **"Microscope: Accuracy and Practicability of Commercially Available Keychain Microscopes."** This study is part of our academic requirements and aims to evaluate the accuracy and practicality of commercially available microscopes in educational settings, specifically in analyzing Peripheral Blood Smears stained with Wright stain. Our objective is to assess their potential as portable alternatives to traditional microscopes, thereby enhancing laboratory education.

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To ensure the credibility of our research, we kindly request the participation of your institution's Registered Medical Technologists (RMTs) and Pathologists who meet the following criteria:

- Hold valid licenses as Registered Medical Technologists (RMTs) and Pathologists.
- Have a minimum of one year of practical experience focused on PBS using traditional microscopy.

Rest assured that all collected data will be treated with the utmost confidentiality and used solely for research purposes. We are committed to upholding ethical research principles, ensuring that participants' rights are protected, and maintaining the highest standards of data privacy. If you have any questions or require further clarification, please feel free to contact the lead proponent:

Name: Irish Nicole C. Ponce (BMLS III-1)
Phone number: 09926938108
E-mail: irishnicole.ponce@lorma.edu

We aim to complete the data gathering by **April 10, 2025**. Rest assured that all collected data will be treated with the utmost confidentiality and used solely for research purposes. We are committed to upholding ethical research principles, ensuring that participants' rights are protected, and maintaining the highest standards of data privacy. Thank you, and may your institution continue to be blessed with success.

Yours respectfully,

JEANNIE PRINCESS D. AQUINO

ANGEL LEAH V. COMBRANG

MICHAELA LUISA A. FLORDEUS

IRISH NICOLE C. PONCE

APRIL SOTH MILLANUEVA

VENICE JANE M. TALAVERA

Noted by:

Mark Ericson B. Baladad, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science

Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science

Conformed:

(Signature over printed name)

(Date signed)



March 20, 2025

HON. GARY N. PINZON

Municipal Mayor
Luna, La Union

Greetings with a LORMA smile!

We, the undersigned third-year students from the LORMA - College of Medical Laboratory Science, are currently conducting a research study entitled **"Makeroscope: Accuracy and Practicability of Commercially Available Keychain Microscopes."** This study is part of our academic requirements and aims to evaluate the accuracy and practicality of commercially available microscopes in educational settings, specifically in analyzing Peripheral Blood Smears stained with Wright stain. Our objective is to assess their potential as portable alternatives to traditional microscopes, thereby enhancing laboratory education.

As part of our research process, we plan to conduct our study in your municipality by visiting your clinical laboratory to perform on-site evaluations and data collection. We are humbly seeking your permission and support to allow us access to your facility for the purpose of assessing the microscopes in use and gathering insights from Registered Medical Technologists (RMTs) and Pathologists.

To ensure the credibility of our research, we kindly request the participation of your institution's Registered Medical Technologists (RMTs) and Pathologists who meet the following criteria:

- Hold valid licenses as Registered Medical Technologists (RMTs) and Pathologists.
- Have a minimum of one year of practical experience focused on PBS using traditional microscopy.

Rest assured that all collected data will be treated with the utmost confidentiality and used solely for research purposes. We are committed to upholding ethical research principles, ensuring that participants' rights are protected, and maintaining the highest standards of data privacy. If you have any questions or require further clarification, please feel free to contact the lead proponent:

Name: Irish Nicole C. Ponce (BMLS III-1)
Phone number: 09926938108
E-mail: irishnicole.ponce@lorma.edu

We aim to complete the data gathering by **March 31, 2025**. Rest assured that all collected data will be treated with the utmost confidentiality and used solely for research purposes. We are committed to upholding ethical research principles, ensuring that participants' rights are protected, and maintaining the highest standards of data privacy. Thank you, and may your institution continue to be blessed with success.

Yours respectfully,

JEANNE PRINCESS D. AQUINO

ANGELIEAN V. COMBONG

MICHAELA LUISA A. FLORDELIS

IRISH NICOLE C. PONCE

APRIL JOH MILLANUEVA

VENICE JANE M. TALAVERA

Noted by:

Mark Ericson B. Baladad, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science

Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science

Conformed:

(Signature over printed name)

RECEIVED
OFFICE OF
Hon. GARY N. PINZON
Municipal Mayor
Luna, La Union
Date: March 20, 2025 Time: 11:11 AM
Received By: _____



April __, 2025

Dr. Amerlito Nuesca
Anatomic and Clinical Pathologist
Santol, La Union

Greetings with a LORMA smile!

We, the undersigned third-year students from the LORMA - College of Medical Laboratory Science, are currently conducting a research study entitled "Makecroscope: Accuracy and Practicability of Commercially Available Keychain Microscopes." This study is part of our academic requirements and aims to evaluate the accuracy and practicality of commercially available microscopes in educational settings, specifically in analyzing Peripheral Blood Smears stained with Wright stain. Our objective is to assess their potential as portable alternatives to traditional microscopes, thereby enhancing laboratory education.

As part of our research process, we plan to conduct on-site evaluations and data collection. We are humbly seeking your permission and support to allow us access to your laboratory for the purpose of assessing the microscopes in use and gathering insights from you as a Pathologist.

To ensure the credibility of our research, we kindly request your participation as a Pathologist who meets the following criteria:

- Holds a valid license as a Pathologist.
- Has a minimum of one year of practical experience focused on Peripheral Blood Smear analysis using traditional microscopy.

Rest assured that all collected data will be treated with the utmost confidentiality and used solely for research purposes. We are committed to upholding ethical research principles, ensuring that participants' rights are protected, and maintaining the highest standards of data privacy. If you have any questions or require further clarification, please feel free to contact the lead proponent:

Name: Irish Nicole C. Ponce (BMLS III-1)
Phone number: 09926938108
E-mail: irishnicole.ponce@lorma.edu

We aim to complete the data gathering by April 15, 2025. Rest assured that all collected data will be treated with the utmost confidentiality and used solely for research purposes. We are committed to upholding ethical research principles, ensuring that participants' rights are protected, and maintaining the highest standards of data privacy.

Yours respectfully,

JEANNE PRINCESS D. AQUINO

ANGELICA V. COMBONG

MICHAELA LUISA A. FLORDELIS

IRISH NICOLE C. PONCE

APRIL JOY M. MILLANUEVA

VENICE JANE M. YALAVERA

Noted by:

Mark Erickson B. Baledad, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science

Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science

Confirmed:



March __, 2025

To Whom It May Concern,

Greetings with a LORMA smile!

We, the undersigned third-year students from the LORMA - College of Medical Laboratory Science, are currently conducting a research study entitled **"Makeroscope: Accuracy and Practicability of Commercially Available Keychain Microscopes."** This study is part of our academic requirements and aims to evaluate the accuracy and practicality of commercially available microscopes in educational settings, specifically in analyzing Peripheral Blood Smears stained with Wright stain. Our objective is to assess their potential as portable alternatives to traditional microscopes, thereby enhancing laboratory education.

As part of our research process, we plan to conduct our study in your municipality by visiting your clinical laboratory to perform on-site evaluations and data collection. We are humbly seeking your permission and support to allow us access to your facility for the purpose of assessing the microscopes in use and gathering insights from Registered Medical Technologists (RMTs) and Pathologists.

To ensure the credibility of our research, we kindly request the participation of your institution's Registered Medical Technologists (RMTs) and Pathologists who meet the following criteria:

- Hold valid licenses as Registered Medical Technologists (RMTs) and Pathologists.
- Have a minimum of one year of practical experience focused on PBS using traditional microscopy.

Rest assured that all collected data will be treated with the utmost confidentiality and used solely for research purposes. We are committed to upholding ethical research principles, ensuring that participants' rights are protected, and maintaining the highest standards of data privacy. If you have any questions or require further clarification, please feel free to contact the lead proponent:

Name: Irish Nicole C. Ponce (BMLS III-1)
Phone number: 09926938108
E-mail: irishnicole.ponce@lorma.edu

We aim to complete the data gathering by **March 31, 2025**. Rest assured that all collected data will be treated with the utmost confidentiality and used solely for research purposes. We are committed to upholding ethical research principles, ensuring that participants' rights are protected, and maintaining the highest standards of data privacy. Thank you, and may your institution continue to be blessed with success.

Yours respectfully,

JEANNE PRINCESS D. AQUINO

ANGEL LEAH V. COMILANG

MICHAELA LUISA A. FLORDEUS

IRISH NICOLE C. PONCE

APRIL JOY U. VILLANUEVA

VENICE JANE M. TALAVERA

Noted by:

Mark Ericson B. Baladad, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science

Josephine V. Culaton, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science

Conformed:

waiting research protocol
thru email 3/11/25



March __, 2025

MUNICIPALITY OF BANGAR
OFFICE OF THE MAYOR

To Whom It May Concern,

Greetings with a LORMA smile!

March 24, 2025

Received by: _____

We, the undersigned third-year students from the LORMA - College of Medical Laboratory Science, are currently conducting a research study entitled **"Microscope: Accuracy and Practicability of Commercially Available Keychain Microscopes."** This study is part of our academic requirements and aims to evaluate the accuracy and practicality of commercially available microscopes in educational settings, specifically in analyzing Peripheral Blood Smears stained with Wright stain. Our objective is to assess their potential as portable alternatives to traditional microscopes, thereby enhancing laboratory education.

As part of our research process, we plan to conduct our study in your municipality by visiting your clinical laboratory to perform on-site evaluations and data collection. We are humbly seeking your permission and support to allow us access to your facility for the purpose of assessing the microscopes in use and gathering insights from Registered Medical Technologists (RMTs) and Pathologists.

To ensure the credibility of our research, we kindly request the participation of your institution's Registered Medical Technologists (RMTs) and Pathologists who meet the following criteria:

- Hold valid licenses as Registered Medical Technologists (RMTs) and Pathologists.
- Have a minimum of one year of practical experience focused on PBS using traditional microscopy.

Rest assured that all collected data will be treated with the utmost confidentiality and used solely for research purposes. We are committed to upholding ethical research principles, ensuring that participants' rights are protected, and maintaining the highest standards of data privacy. If you have any questions or require further clarification, please feel free to contact the lead proponent:

Name: Irish Nicole C. Ponce (BMLS III-1)
Phone number: 09926938108
E-mail: irishnicole.ponce@lorma.edu

We aim to complete the data gathering by **March 31, 2025**. Rest assured that all collected data will be treated with the utmost confidentiality and used solely for research purposes. We are committed to upholding ethical research principles, ensuring that participants' rights are protected, and maintaining the highest standards of data privacy. Thank you, and may your institution continue to be blessed with success.

Yours respectfully,

JEANNE PRIMCESS D. AQUINO

ANGELIAH V. COMILANG

MICHAELA LUISA A. FLORDELIS

IRISH NICOLE C. PONCE

APRIL JOY L. VILLANUEVA

VENICE JANE M. TALAVERA

Noted by:

Mark Ericson B. Baladad, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science

Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science

Conformed:



March 18, 2025

ATTY. ALELI U. CONCEPCION
Municipal Mayor
Balaan, La Union

Greetings with a LORMA smile!

We, the undersigned third-year students from the LORMA - College of Medical Laboratory Science, are currently conducting a research study entitled **"Makecroscope: Accuracy and Practicability of Commercially Available Keychain Microscopes."** This study is part of our academic requirements and aims to evaluate the accuracy and practicality of commercially available microscopes in educational settings, specifically in analyzing Peripheral Blood Smears stained with Wright stain. Our objective is to assess their potential as portable alternatives to traditional microscopes, thereby enhancing laboratory education.

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JEANNINE PRINCESS D. AQUINO

ANGEL LEAH V. COMBARING

MICHAELA LUISA A. FLORDEELIS

IRISH NICOLE C. PONCE

APRIL JOY VILLANUEVA

VENICE JANE M. TALAVERA

Noted by:

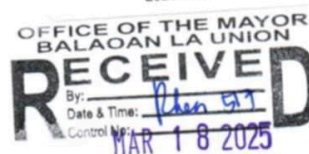
Mark Ericson B. Baladad, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science

Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science

Conformed:

(Signature over printed name)

(Date signed)



APPENDIX D

Approval Letter from LORMA Colleges - Review Ethics Committee (LC-REC)



LC-REC Form #024
APPROVAL LETTER

REC Reference #: 2025-051

February 24, 2025

To: Jeanne Princess Aquino, Angeli Jeah Comilang, Michaela Luisa Flordelis, Irish Nicole Ponce, Venice Jane Talavera
and April Joy Villanueva
LORMA Colleges, College of Medical Laboratory Science

Subject: Approval of the Research Study "THE EFFECTIVENESS OF COMMERCIALY - AVAILABLE MICROSCOPE IN ASSESSING THE ACCURACY OF CELL MORPHOLOGY AND ITS PRACTICABILITY THROUGH RESOLUTION TEST" by the Research Ethics Committee (REC).

Dear Researchers,

The Research Ethics Committee (REC) has reviewed your application to conduct the above-mentioned research study in the LOCALE OF STUDY with you as the Principal Investigators within the duration of February 24, 2025 to February 24, 2026.

The Following documents have been reviewed and approved:

1. Letter of Intent to Conduct the Study
2. Endorsement of the Research Technical Panel
3. Title and Statement of the Problem/ Objective
4. Literature Review
5. Methods and Procedures
6. Population and Locale
7. Exclusion/Inclusion Criteria
8. Data Analysis
9. Ethical Considerations

We approve the study to be conducted in the presented form provided the following are integrated in the final research protocol:

1. The research paradigm will be revised from the I-P-O Model to a causal paradigm.
2. Ethical considerations should be clearly specified in the manuscript – voluntary participation, anonymity, confidentiality, non-maleficence and the right to withdraw of the respondents. Specify also the amount of blood to be extracted and for how many students.
3. In the data gathering procedure, revisit page 30 – the statement seems not about the procurement of the kit but more about promoting the kit. Provide also the validation of the questionnaire.
4. Clearly describe the approval process of the study, provide an informed consent form for the students for blood extraction and state the ICF as if directly communicating with the respondents.

None of the Investigators participating in this study took part in the decision making and voting procedure for this study.

The Institutional REC expects to be informed about the progress of the study, any revision in the protocol before implementation and participants'/respondents' information/informed consent. Likewise, you are required to provide the Board a copy of the final report.

Yours Sincerely,


BEVERLY B. BARUT, RPh

Informed Consent Form



LC-REC Form #009
INFORMED CONSENT FORM

INFORMED CONSENT FORM

INSTRUCTION: Please accomplish the form and ensure that all necessary documents are included in your submission.

GENERAL INFORMATION:

Title of the Study: Make-roscope: Accuracy and Practicability of Commercially Available Keychain Microscope

REC Code : 8024

No. of Study Participants: 50 Study

Site: 1st Congressional District of the Province of La Union, Philippines

Name of Researcher/s: Jeanne Princess D. Aquino, Angeli Jeah V. Comilang, Michaela Luisa A. Flordelis, Irish Nicole C. Ponce, Venice Jane M. Talavera, and April Joy Villanueva

Contact Information: Telephone Number: N/A

Mobile Number: 09166429573

Fax Number: N/A

Email: irishnicole.ponce@lorma.edu

Name of Institution: Lorma Colleges

Institution's Address: Brgy. Carlatan, City of San Fernando, La Union

Type of Study: ☐ Sponsored Clinical Trial ☐ Biomedical Research
☐ Researcher-Initiated Clinical Trials ☐ Stem Cell Research
☐ Health Operations Research ☐ Genetic Research
☐ Social or Behavioral Research ☐ Others: _____
☐ Public Health or Epidemiologic

Source of Funding: ☐ Self-Funded ☐ Scholarship/Research Grant
☐ Government-Funded ☐ Institution-Funded
☐ Sponsored by Pharmaceutical Company
☐ Others: _____

Duration of the Study: Start Date: August 2024

End Date: May 2025

INTRODUCTION

This research compiles insights from recent advancements in commercially obtainable microscopes, particularly focusing on their use in educational settings. Wang et al. (2023) analyzed the efficiency of these microscopes in routine laboratory tasks, underscoring their cost-effectiveness and practical usability. These microscopes merge superior optical capabilities with digital integration, rendering them a viable substitute for pricier, high-end models that are frequently utilized in research yet not always accessible in educational institutions. In a related context, Smith and Johnson (2022)

explored the implementation of digital microscopes in fieldwork and point-of-care, underscoring their user-friendliness and real-time imaging features. These instruments are especially advantageous for promoting interactive educational experiences, as they enable learners to observe and examine specimens instantly, boosting involvement and understanding. Digital microscopes are also advantageous in environments with limited resources, offering an attainable substitute for schools that might lack the financial means for conventional models. Microscopy technology has experienced significant advancement in recent years, and the presence of commercially affordable microscopes is altering how microscopy is incorporated into educational methodologies. This investigation, titled “Make-roscope: Accuracy and Practicability of Commercially Available Keychain Microscope,” aims to evaluate how these microscopes can enhance laboratory experiences in educational settings. By concentrating on their accuracy, reliability, and cost-efficiency, this study aims to determine how these instruments can improve science education and bridge the gap between traditional and modern microscopy techniques in the classroom.

PURPOSE OF RESEARCH

This research aims to evaluate the practicability and effectiveness of commercially available keychain microscopes as educational tools for microscopy training. It focuses on their ability to provide clear and accurate images of Peripheral Blood Smears (PBS) stained with Wright Stain, comparing them to traditional compound microscopes. The study explores their usability, portability, and cost-effectiveness, particularly for students and institutions with limited access to standard laboratory equipment. It also examines student perceptions regarding ease of use and learning experience when utilizing keychain microscopes. Additionally, the research investigates whether these microscopes can enhance engagement and support independent learning outside the laboratory. By analyzing user feedback, it aims to determine their role in reinforcing theoretical and practical microscopy knowledge. Ultimately, the study seeks to provide data-driven insights into the potential of keychain microscopes as accessible and practical educational tools.

TYPE OF RESEARCH INTERVENTION

1. Participant Selection

The study will employ stratified sampling to identify and select participants who possess expertise in laboratory practices, particularly in peripheral blood smear analysis and microscopy. This method ensures the inclusion of individuals who can provide relevant and meaningful data aligned with the research objectives. The participants will include registered medical technologists and pathologists with at least one year of experience using traditional compound microscopes. They will be drawn from the Municipal Health Units located in Bacnotan, Balaoan, Bangar, City of San Fernando, Luna, San Gabriel, San Juan, Santol, and Sudipen, within the first congressional district of La Union. This strategy guarantees that the study is conducted with participants who have substantial and practical knowledge in the field.

2. Voluntary Participation

Participation in this study is entirely voluntary. Participants are under no obligation to take part and may decline or withdraw from the study at any stage without needing to provide an explanation. To reinforce the voluntary nature of participation, the researchers will provide all participants with an Informed Consent Form, which outlines the study's purpose, procedures, risks, benefits, and confidentiality measures. Only participants who provide written informed consent will be included in the study.

3. Procedures

The study will follow a systematic and ethical approach to ensure accurate data collection and evaluation. Initially, participants, including registered medical technologists and pathologists, will attend an orientation session. During this session, they will be briefed on the study's objectives, procedures, and ethical guidelines, ensuring transparency and an opportunity to address any questions. Written informed consent will be obtained from all participants, affirming their voluntary participation and understanding of the study process. The data gathering procedure for this study will be conducted systematically to ensure the accuracy and reliability of the results. The process will begin by preparing two groups: the experimental group, which will use the commercially available microscope, and the control group, which will use the traditional compound microscope. After using the microscope kits, participants will complete a structured questionnaire. All data, including feedback and survey responses, will be securely stored to maintain confidentiality. The findings will be analyzed to draw meaningful conclusions about the practicality and effectiveness of commercially available microscope kits in laboratory and educational settings

4. Risks

This study poses no known risks to participants. The intervention involves the use of commercially available microscope kits, which have been deemed safe for routine use. Efforts will be made to minimize any potential inconvenience or discomfort during the study, such as ensuring participants have access to an appropriate workspace, necessary supplies, and adequate time for the intervention.

5. Benefits

By participating in this study, laboratory professionals will have the opportunity to contribute valuable insights regarding the practical application of commercially available microscope kits in educational settings. This research may provide valuable insights to enhance laboratory teaching strategies and training in educational settings. Additionally, the feedback provided by participants may serve as a basis for refining the design of commercially available microscope kits.

6. Reimbursements

Participants will not receive monetary or material compensation for their participation. However, their contribution will be acknowledged as an integral part of the research process, highlighting the significance of their role in achieving the study's objectives.

7. Confidentiality

All personal information and responses collected during the study will remain confidential. Participant responses will be anonymized and used exclusively for academic purposes. Data will be securely stored and accessible only to the researchers.

8. Sharing of Results

The findings of the study will be shared through academic publications or presentations, but no personally identifiable information will be disclosed. The dissemination of results will focus on overall trends and conclusions drawn from the study, maintaining the anonymity of all participants.

9. Right to Refuse or Withdrawal

Participants have the right to refuse or withdraw from the study at any time without penalty. Should a participant withdraw, any data they have provided will be excluded from the study.

10. Who to Contact

For any concerns or inquiries, participants may contact Irish Nicole C. Ponce, the research leader, via email at irishnicole.ponce@lorma.edu or by phone at 09166429573. Participants are encouraged to communicate any questions or issues regarding their participation in the study.

APPENDIX F

Letter of Request for Laboratory Materials



LORMA COLLEGES
Our Pathway to a Brighter Future

LORMA COLLEGES
Carlutan, City of San Fernando
La Union, 2500 Philippines

COLLEGE OF MEDICAL LABORATORY SCIENCE



RESEARCH 2 REQUEST FOR LABORATORY MATERIALS

Title of Research: ACCURACY AND PRACTICABILITY OF COMMERCIALY AVAILABLE MICROSCOPE

Approximate date of use: February - April 2025

MATERIAL/REAGENT	AMOUNT NEEDED	NOTES	STOCKS
Wright-Giemsa Stain	1 bottle	C/O Student	Wright stain
Compound Microscope	38	C/O Student	

Prepared by:

1. Jeanne Princess D. Aquino
2. Angel Jean V. Camilang
3. Michaela Luisa A. Flordelis
4. Irish Nicole C. Ponce
5. Venice Jane M. Talavera
6. April L. Villanueva

Checked by:

MARK ERICSON B. BALADAD, MMPHA, RMT
Research Adviser, CMLS

Confirmed and verified by:

HAZEL B. BENING, RMT
Laboratory Custodian, CMLS

Noted by:

RYAN JAY G. MOSTOLES, RMT, CT, MASE
Laboratory Courses Coordinator, CMLS

Approved by:

JOSEPHINE C. MILAN, RMT, MSMT
Dean, CMLS

APPENDIX G

Letters for the Validity and Reliability Testing



LORMA COLLEGE OF MEDICAL LABORATORY SCIENCE
Carlatan, City of San Fernando, La Union, Philippines, 2500
Facebook: @LormaCMLS | E-mail: cmls@lorma.edu



March 7, 2025

To Whom It May Concern,

Greetings with a LORMA smile!

We, the undersigned Third Year Bachelor of Science in Medical Laboratory Science students from LORMA College of Medical Laboratory Science, are conducting a study entitled "Microscope: Accuracy and Practicability of Commercially Available Keychain Microscopes." As part of this study, we kindly invite you to participate in the validity testing of the research questionnaire we have developed.

The aim of this study is to evaluate the effectiveness and practicality of commercially available microscopes in educational settings, specifically for analyzing Peripheral Blood Smears stained with Giemsa stain. To ensure that our research questionnaire is valid, we are conducting validity testing, and your feedback will be instrumental in assessing the consistency and dependability of the questionnaire.

As a participant in the validity testing, you will be asked to complete the questionnaire and provide feedback on its clarity, ease of understanding, and any areas that may need further improvement. Your valuable input will help us refine the questionnaire and ensure that it can effectively capture the data needed for our study.

Please note that participation is voluntary, and you may withdraw at any time without any consequences. All information you provide will be kept confidential and used solely for the purposes of this study.

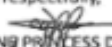
Should you have any questions or need further clarification regarding the study or your participation, please do not hesitate to contact the lead researcher:

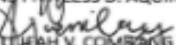
Name: Irish Nicole C. Ponce (BMLS III-1)
Phone number: 09926938108
E-mail: irishnicole.ponce@lorma.edu

Once again, we sincerely thank you for your valuable contribution to this study. Your participation will significantly enhance the quality and credibility of our research.

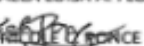
Thank you for your kind support, and may you continue to be blessed.

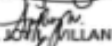
Yours respectfully,


JEANNIE PRINCESS D. AQUINO


ANGEL LEAH Y. COMASONG


MICHAELA LUISA A. FLORDEELIS

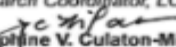

IRISH NICOLE C. PONCE


APRIL JOY VILLANUEVA


VENICE JANE M. TALAVERA

Noted by:


Mark Ericson B. Baladad, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science


Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science





March 7, 2025

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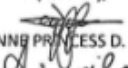
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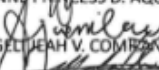
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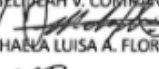
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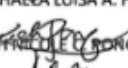
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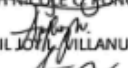
Yours respectfully,

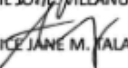

JEANNETTE D. AQUINO


ANGELIAH V. COMBARING

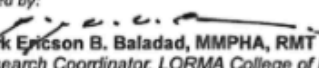

MICHAELA LUISA A. FLORDEUS

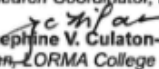

IRISH NICOLE C. PONCE


APRIL JOY VILLANUEVA


VENICE JANE M. TALAVERA

Noted by:


Mark Ericson B. Baladad, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science


Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science





March 7, 2025

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E-mail: irishnicole.ponce@lorma.edu

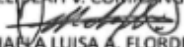
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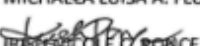
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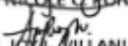
Yours respectfully,

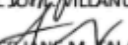

JEANNE PRINCESS D. AQUINO


ANGEL JEHN V. COMBARING

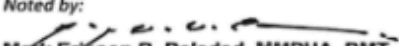

MICHAELA LUISA A. FLORDEUS

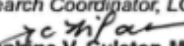

IRISH NICOLE C. PONCE


APRIL JOY VILLANUEVA


VENICE JANE M. TALAVERA

Noted by:


Mark Ericson B. Baladad, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science


Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science





March 10, 2025

To Whom It May Concern,

Greetings with a LORMA smile!

We, the undersigned third-year Bachelor of Science in Medical Laboratory Science students from the LORMA College of Medical Laboratory Science, are conducting a study entitled: "Makecroscope: Accuracy and Practicability of Commercially Available Keychain Microscopes" as part of our academic requirements." The purpose of this study is to evaluate the accuracy and practicality of commercially available microscopes in educational settings, specifically in analyzing Peripheral Blood Smears stained with Wright stain. This study will assess their reliability and potential as portable alternatives to traditional microscopes, enhancing laboratory education.

As part of our research process, we are conducting reliability testing of the questionnaire we developed for the study. We are seeking your kind permission to involve your institution's Registered Medical Technologists (RMTs) and Pathologists as participants in this reliability testing phase.

To be eligible for participation, the professionals must:

- Hold valid licenses as Registered Medical Technologists (RMTs) and Pathologists.
- Have a minimum of one year of practical experience focused on traditional microscopy.

Your support and approval would greatly contribute to ensuring that our data collection tool is effective and accurate. If you agree to participate, we kindly request that you allow us to distribute the questionnaire to your professionals for their feedback. Rest assured, all responses will be kept confidential, and their involvement will be solely for the purpose of testing the reliability of the questionnaire. We would like to assure you that all information gathered will be treated with the utmost confidentiality. We are committed to ensuring the anonymity of all participants, as well as to adhering to the highest standards of data privacy. All collected data will be used solely for the purposes of this study, and ethical considerations such as beneficence will be strictly observed to ensure that the participants' rights are protected.

If you have any questions or need further clarification, please feel free to contact the lead proponent:

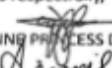
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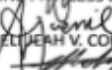
Phone number: 09926938108

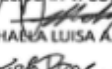
E-mail: irishnicole.ponce@lorma.edu

We respectfully await your favorable reply and thank you in advance for considering our request. Your participation in this process would be invaluable to the success of our study. Thank you, and may you and your institution continue to be blessed.

Yours respectfully,

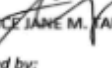

JEANNINE P. LESS D. AQUINO


ANGEL LEAH V. COMAS


MICHANA LUISA A. FLORDELIS


IRISH NICOLE C. PONCE


APRIL JOY MILLANUEVA


VENICE JANE M. TALAVERA

Noted by:


Mark Ericson B. Baladad, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science


Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science





March 11, 2025

To Whom It May Concern,

Greetings with a LORMA smile!

We, the undersigned third-year Bachelor of Science in Medical Laboratory Science students from the LORMA College of Medical Laboratory Science, are conducting a study entitled: "Makecroscope: Accuracy and Practicability of Commercially Available Keychain Microscopes" as part of our academic requirements. The purpose of this study is to evaluate the accuracy and practicality of commercially available microscopes in educational settings, specifically in analyzing Peripheral Blood Smears stained with Wright stain. This study will assess their reliability and potential as portable alternatives to traditional microscopes, enhancing laboratory education.

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If you have any questions or need further clarification, please feel free to contact the lead proponent:

Name: Irish Nicole C. Ponce (BMLS III-1)

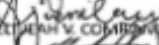
Phone number: 09926938108

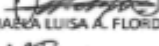
E-mail: irishnicole.ponce@lorma.edu

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Yours respectfully,

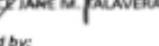

JEANNIE PROCESSA D. AQUINO


ANGEL LEAH V. COMBING

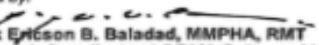

MICHAELA LUISA A. FLORDELES

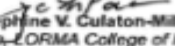

JEFFREY L. PONCE


APRIL SOTH VILLANUEVA


VENICE JANE M. TALAVERA

Noted by:


Mark Ericson B. Baladad, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science


Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science





March 11, 2025

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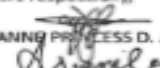
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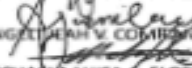
If you have any questions or need further clarification, please feel free to contact the lead proponent:

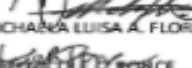
Name: Irish Nicole C. Ponce (BMLS III-1)
Phone number: 09926938108
E-mail: irishnicole.ponce@lorma.edu

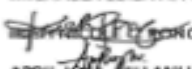
We respectfully await your favorable reply and thank you in advance for considering our request. Your participation in this process would be invaluable to the success of our study. Thank you, and may you and your institution continue to be blessed.

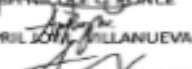
Yours respectfully,


JEANNIE PRINCESS D. AQUINO


ANGELI JEAN V. COMBES


MICHAELA LUISA A. FLORDE

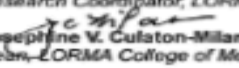

IRISH NICOLE C. PONCE


APRIL JOY M. VILLANUEVA


VENICE JANE M. TALAVERA

Noted by:


Mark Ericson B. Baladad, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science


Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science





March 7, 2025

To Whom It May Concern,

Greetings with a LORMA smile!

We, the undersigned third-year Bachelor of Science in Medical Laboratory Science students from the LORMA College of Medical Laboratory Science, are conducting a study entitled: "Accuracy and Practicability of Commercially Available Microscopes" as part of our academic requirements. The purpose of this study is to evaluate the accuracy and practicality of commercially available microscopes in educational settings, specifically in analyzing Peripheral Blood Smears stained with Wright-Giemsa stain. This study will assess their reliability and potential as portable alternatives to traditional microscopes, enhancing laboratory education.

As part of our research process, we are conducting reliability testing of the questionnaire we developed for the study. We are seeking your kind permission to involve your Institution's Registered Medical Technologists (RMTs) and Pathologists as participants in this reliability testing phase.

To be eligible for participation, the professionals must:

- Hold valid licenses as Registered Medical Technologists (RMTs) and Pathologists.
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Your support and approval would greatly contribute to ensuring that our data collection tool is effective and accurate. If you agree to participate, we kindly request that you allow us to distribute the questionnaire to your professionals for their feedback. Rest assured, all responses will be kept confidential, and their involvement will be solely for the purpose of testing the validity of the questionnaire. We would like to assure you that all information gathered will be treated with the utmost confidentiality. We are committed to ensuring the anonymity of all participants, as well as adhering to the highest standards of data privacy. All collected data will be used solely for the purposes of this study, and ethical considerations such as beneficence will be strictly observed to ensure that the participants' rights are protected.

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Name: Irish Nicole C. Ponce (BMLS III-1)

Phone number: 09926938108

E-mail: irishnicole.ponce@lorma.edu

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Yours respectfully,

JEANNE PRINCESS D. AQUINO

IRISH NICOLE C. PONCE

ANGELIEAH V. COMILANG

APRIL JOY L. VILLANUEVA

MICHAELA LUISA A. FLORDELIS

VENICE JANE M. TALAVERA

Noted by:

Mark Ericson B. Baladad, MMPHA, RMT

Instructor, Research Lecture and Laboratory (Research Adviser)

Josephine Y. Culaton-Milan, MSMT, RMT

Dean, LORMA College of Medical Laboratory Science

Conformed:

May 09 2025
(Signature over printed name)

03-09-2025
(Date signed)



March 1, 2025

To Whom It May Concern,

Greetings with a LORMA smile!

We, the undersigned third-year Bachelor of Science in Medical Laboratory Science students from the LORMA College of Medical Laboratory Science, are conducting a study entitled: "Accuracy and Practicability of Commercially Available Microscopes" as part of our academic requirements. The purpose of this study is to evaluate the accuracy and practicality of commercially available microscopes in educational settings, specifically in analyzing Peripheral Blood Smears stained with Wright-Giemsa stain. This study will assess their reliability and potential as portable alternatives to traditional microscopes, enhancing laboratory education.

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IRISH NICOLE C. PONCE

ANGEL LEAH V. COMILANG

APRIL JOY L. VILLANUEVA

MICHAELA LUISA A. FLORDELIS

VENICE JANE M. TALAVERA

Noted by:

Mark Ericson B. Baladad, MMPHA, RMT
Instructor, Research Lecture and Laboratory (Research Adviser)

Josephine Y. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science

Conformed:

(Signature over printed name)

(Date signed)

Approved for 03-07-2025

APPENDIX H

Validity Testing and Validation Tool of Research Questionnaire



LORMA COLLEGES
Your Pathway to a Brighter Future

LORMA COLLEGES
Carlatan, City of San Fernando, La Union
COLLEGE OF MEDICAL LABORATORY SCIENCE



SURVEY INSTRUMENT VALIDATION RATING SCALE

Instruction: Please indicate your degree of agreement or disagreement on the statements provided below by encircling the number which corresponds to your best to your judgment.

1 – Strongly Disagree 2 – Disagree 3 – Undecided 4 – Agree 5 – Strongly Agree

Criteria	1	2	3	4	5
The items in the instrument are relevant to answer the objectives of the study.	1	2	3	4	5
The items in the instrument can obtain depth to constructs being measured.	1	2	3	4	5
The instrument has an appropriate sample of items for the construct being measured.	1	2	3	4	5
The items and their alternatives are neither too narrow nor limited in its content.	1	2	3	4	5
The items in the instrument are stated clearly.	1	2	3	4	5
The items on the instrument can elicit responses which are stable, definite, consistent and not conflicting.	1	2	3	4	5
The terms adapted in the scale are culturally appropriate.	1	2	3	4	5
The layout or format of the instrument is technically sound.	1	2	3	4	5
The responses on the scale show a reasonable range of variation.	1	2	3	4	5
The instrument is not too short or long enough that the participants will be able to answer it within a given time.	1	2	3	4	5
The instrument is interesting such that participants will be induced to respond to it and accomplish it fully.	1	2	3	4	5
The instrument as a whole could answer the basic purpose for which it is designed.	1	2	3	4	5
The instrument is culturally acceptable when administered in the local setting.	1	2	3	4	5

Comments and Suggestions:



SURVEY INSTRUMENT VALIDATION RATING SCALE

Instruction: Please indicate your degree of agreement or disagreement on the statements provided below by encircling the number which corresponds to your best to your judgment.

1 – Strongly Disagree 2 – Disagree 3 – Undecided 4 – Agree 5 – Strongly Agree

Criteria

The items in the instrument are relevant to answer the objectives of the study.	1	2	3	4	5
The items in the instrument can obtain depth to constructs being measured.	1	2	3	4	5
The instrument has an appropriate sample of items for the construct being measured.	1	2	3	4	5
The items and their alternatives are neither too narrow nor limited in its content.	1	2	3	4	5
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The instrument is not too short or long enough that the participants will be able to answer it within a given time.	1	2	3	4	5
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The instrument is culturally acceptable when administered in the local setting.	1	2	3	4	5

Comments and Suggestions:

Signature over Printed Name

SURVEY INSTRUMENT VALIDATION RATING SCALE by *Ryan Michael F. Oducado*
West Visayas State University, College of Nursing



SURVEY INSTRUMENT VALIDATION RATING SCALE

Instruction: Please indicate your degree of agreement or disagreement on the statements provided below by encircling the number which corresponds to your best to your judgment.

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Criteria

The items in the instrument are relevant to answer the objectives of the study.	1	2	3	4	5
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The instrument as a whole could answer the basic purpose for which it is designed.	1	2	3	4	5
The instrument is culturally acceptable when administered in the local setting.	1	2	3	4	5



Comments and Suggestions:
Change the word "invaluable"



SURVEY INSTRUMENT VALIDATION RATING SCALE

Instruction: Please indicate your degree of agreement or disagreement on the statements provided below by encircling the number which corresponds to your best to your judgment.

1 – Strongly Disagree 2 – Disagree 3 – Undecided 4 – Agree 5 – Strongly Agree

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The instrument is culturally acceptable when administered in the local setting.	1	2	3	4	5



Comments and Suggestions:

Not suitable control & what's the experimental



SURVEY INSTRUMENT VALIDATION RATING SCALE

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Criteria

The items in the instrument are relevant to answer the objectives of the study.	1	2	3	4	5
The items in the instrument can obtain depth to constructs being measured.	1	2	3	4	5
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The items on the instrument can elicit responses which are stable, definite, consistent and not conflicting.	1	2	3	4	5
The terms adapted in the scale are culturally appropriate.	1	2	3	4	5
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APPENDIX I

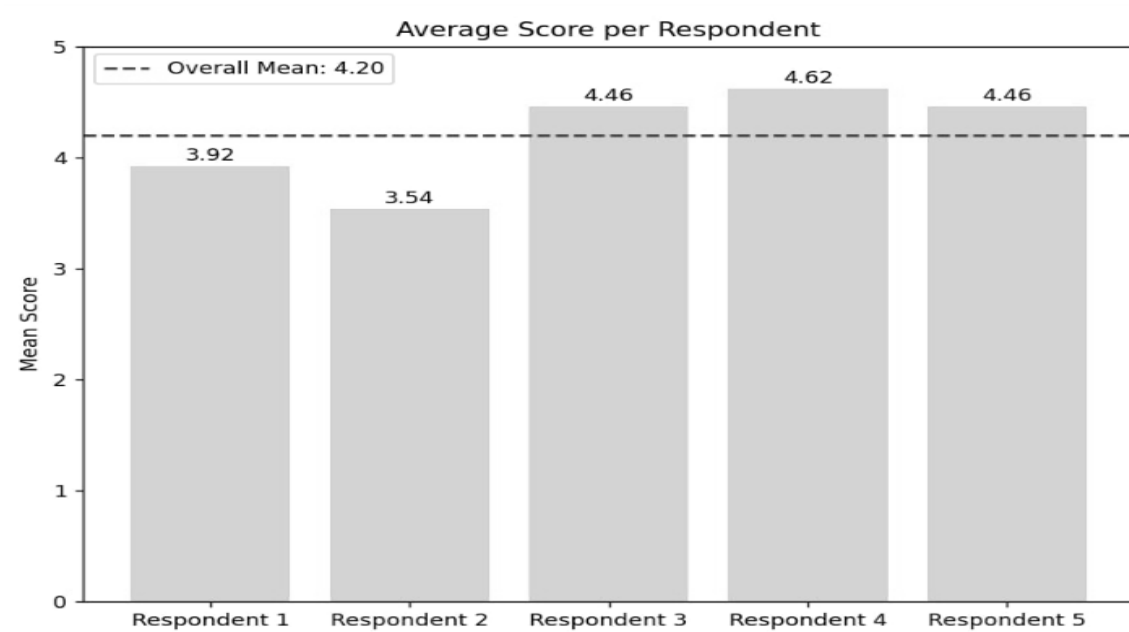
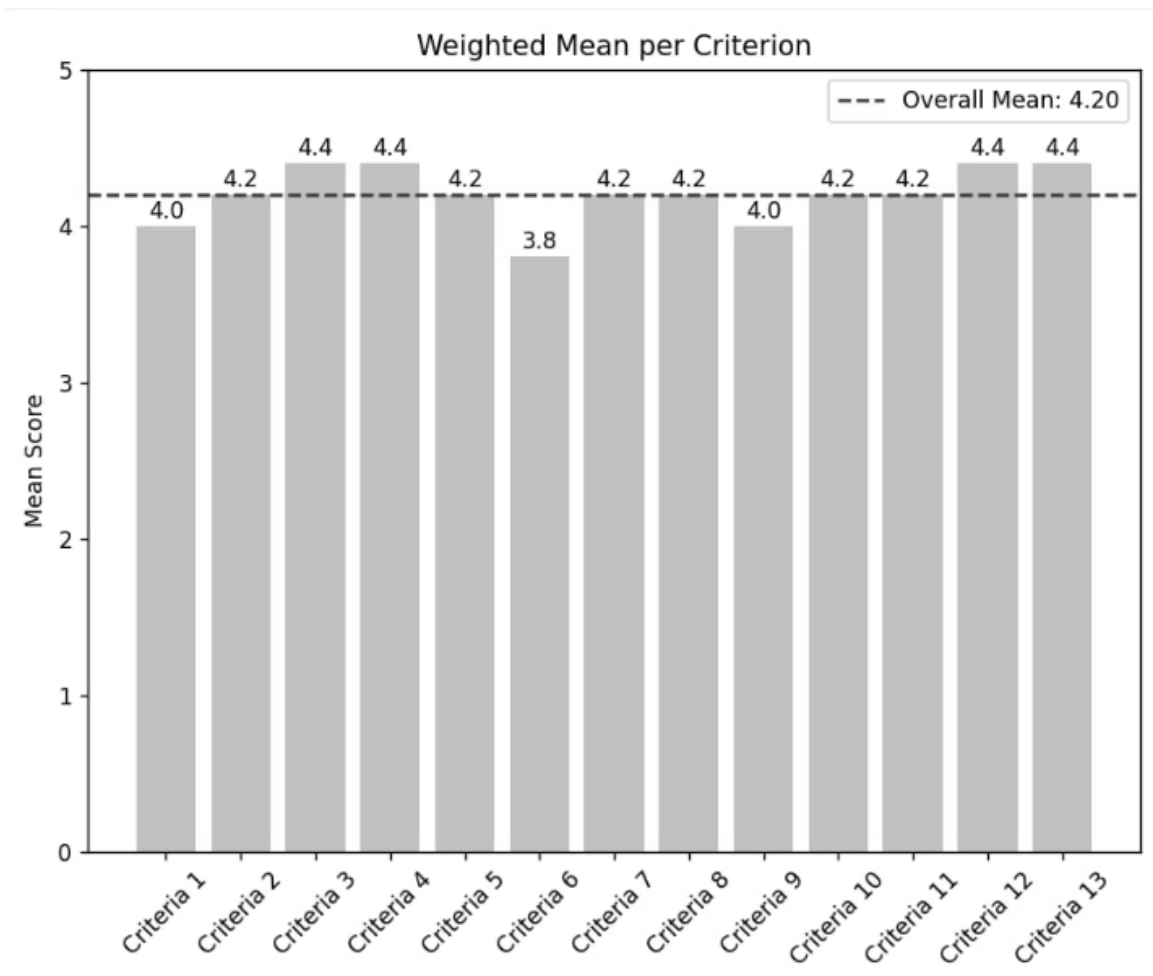
Results of Validation Testing

Validity Indicator	Validators					Average
	Validator 1	Validator 2	Validator 3	Validator 4	Validator 5	
1. The items in the instrument are relevant to answer the objectives of the study.	4	4	4	4	4	4.0
2. The items in the instrument can obtain depth to constructs being measured.	4	4	4	4	5	4.2
3. The instrument has an appropriate sample of items for the construct being measured.	4	4	5	5	4	4.4
4. The items and their alternatives are neither too narrow nor limited in its content	4	3	5	5	5	4.4
5. The items in the instrument are stated clearly.	5	4	4	5	3	4.2
6. The items on the instrument can elicit responses which are stable, definite, consistent and not conflicting.	5	3	3	4	4	3.8
7. The terms adapted in the scale are culturally appropriate.	3	3	5	5	5	4.2
8. The layout or format of the instrument is technically sound.	3	4	4	5	5	4.2
9. The responses on the scale show a reasonable range of variation.	4	3	4	5	4	4.0
10. The instrument is not too short or long enough that the participants will be able to answer it within a given time.	3	4	5	5	4	4.2
11. The instrument is interesting such that participants will be induced to respond to it and accomplish it fully.	4	3	5	4	5	4.2
12. The instrument as a whole could answer the basic purpose for which it is designed.	4	4	5	4	5	4.4
13. The instrument is culturally acceptable when administered in the local setting.	4	3	5	5	5	4.4
Overall	3.92	3.54	4.46	4.62	4.46	4.20

The 4.20 overall computed average is considered highly valid.

To interpret the degree of the questionnaires' validity, the scale below was used:

Point of Scale	Range of Weighted Mean	Descriptive Equivalent
5	4.51 – 5.00	Very High Validity
4	3.51 – 4.50	High Validity
3	2.51 – 3.50	Moderate Validity
2	1.51 – 2.50	Poor Validity
1	1.00 – 1.50	Very Poor Validity



APPENDIX J

Results of Reliability Testing

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
3	3	4	4	4	4	4	4	4	3	3	3	4	4	4
2	3	4	4	4	4	3	3	4	3	3	2	4	4	4
2	3	3	4	4	4	3	3	4	3	3	2	4	4	4
2	3	4	4	4	4	3	3	4	3	3	2	4	4	4
2	3	3	4	4	4	3	3	3	3	3	2	4	4	4
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2	3	3	4	4	4	3	3	3	2	3	2	4	4	4
2	3	4	4	4	4	3	3	4	3	3	2	4	4	4
1	2	3	4	4	4	3	3	3	2	2	1	4	4	4

Number of Items	15
Sum of Item Variances	2.9897
Variance of Total Scores	20.2540
Cronbach's α	0.9133

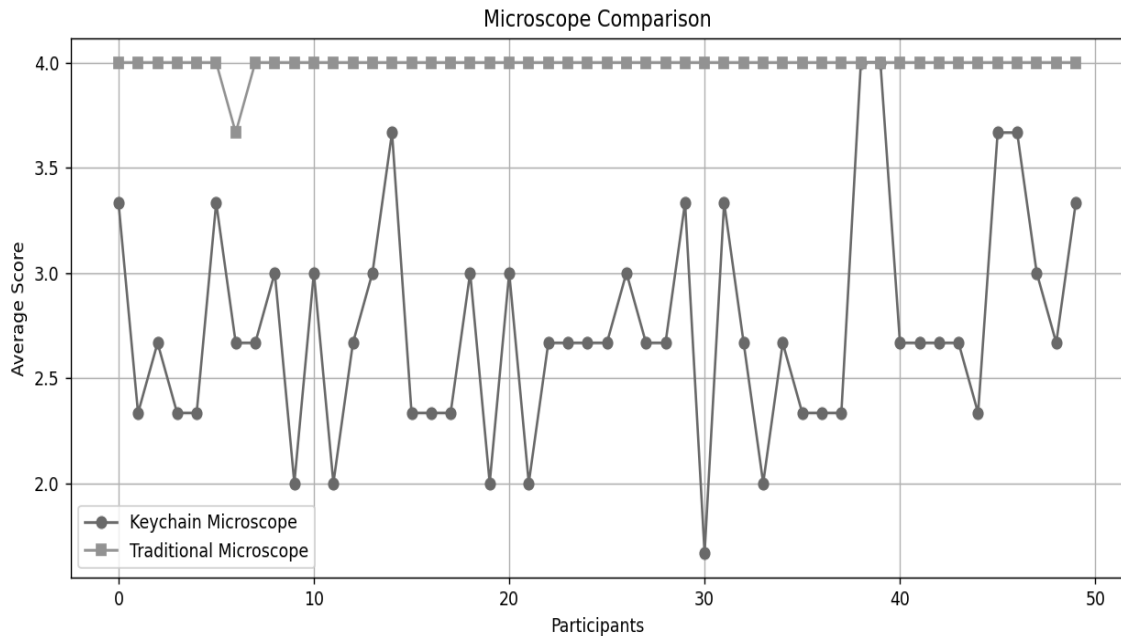
To interpret the degree of reliability of the questionnaire, the following scale was used:

Point Scale	Descriptive Equivalent
± 1.00	Perfect Reliability
$\pm 0.71 - \pm 0.99$	Very High Reliability
$\pm 0.51 - \pm 0.70$	High Reliability
$\pm 0.21 - \pm 0.50$	Low Reliability
$0.01 - \pm 0.20$	Negligible Reliability
0	No Reliability

The 0.91330 reliability is considered **very high reliability**.

APPENDIX K

Results and Computation of the Level of Accuracy of Cell Morphology Assessment in Both Control and Experimental Groups



Weighted Means for Keychain Microscope:

COLOR: 2.2600

SHAPE: 2.8800

STAIN: 3.0800

Weighted Means for Traditional Microscope:

COLOR: 4.0000

SHAPE: 3.9800

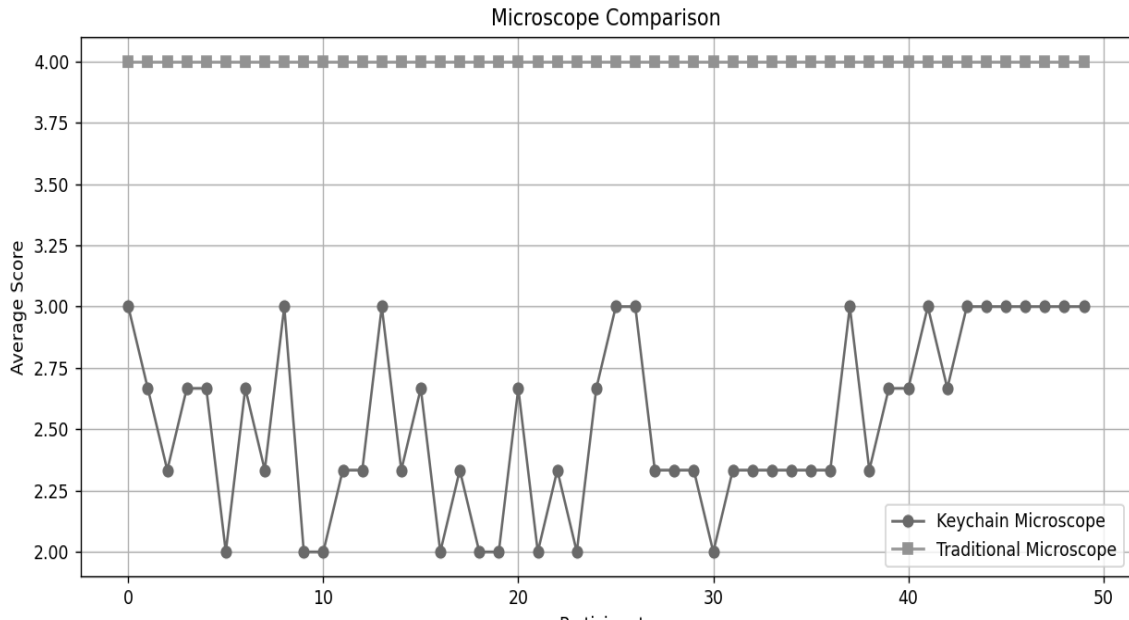
STAIN: 4.0000

Overall Mean for Keychain Microscope: 2.7400

Overall Mean for Traditional Microscope: 3.9933

APPENDIX L

Results and Computation of the Level of Effectiveness of the Experimental and Control Group



Parameter: Contrast

Keychain Weighted Mean = 2.72

Traditional Weighted Mean = 4.00

T-Statistic = -15.7997, P-Value = 0.0000

Parameter: Sharpness

Keychain Weighted Mean = 2.64

Traditional Weighted Mean = 4.00

T-Statistic = -19.8333, P-Value = 0.0000

Parameter: Structural Visibility

Keychain Weighted Mean = 2.22

Traditional Weighted Mean = 4.00

T-Statistic = -16.4806, P-Value = 0.0000

APPENDIX M

Results and Computation of the Perceived Level of Practicability of Commercially Available Keychain Microscope

--- Descriptive Statistics ---

	Mean	Median	Mode	...	Range	Skewness	Kurtosis
Ease of Use	3.26	3.0	3	...	2	-0.343987	-0.712263
Portability	3.50	4.0	4	...	2	-0.396183	-1.052470
Cost Effectiveness	3.18	3.0	3	...	2	-0.252634	-0.839842

APPENDIX N

Research Questionnaire

Research Questionnaire

Ethical consideration

This research study, titled *Make-roscope: Accuracy and Practicability of Commercially Available Keychain Microscopes*, is guided by ethical principles to ensure participants' rights and well-being are protected. Anonymity and confidentiality are prioritized; no identifying information will be collected, and all responses will be aggregated and analyzed only in summary form. Data will be securely stored and used solely for academic purposes, ensuring participants' privacy. Participation in this study is entirely voluntary. Respondents may skip any question or withdraw from the study at any time without consequences or the need for explanation. The study is designed to promote beneficence by generating insights that benefit laboratory professionals and educators through an improved understanding of the practicality of commercially available keychain microscope kits. Efforts are also made to adhere to the principle of non-maleficence, ensuring no harm—physical, psychological, or social—comes to participants as a result of their involvement.

By proceeding with the questionnaire, participants acknowledge they have understood the study's purpose and ethical considerations, and they provide informed consent to participate. The estimated time required to complete the survey or observation is approximately 20-30 minutes. For any concerns or inquiries, participants may contact the research leader at irishnicole.ponce@lorma.edu

Instructions to Respondents

1. Kindly answer all questions honestly and to the best of your knowledge and experience.
2. For scaled questions, choose the response that best reflects your perception or experience.
3. Provide detailed answers to open-ended questions to ensure a comprehensive understanding of your perspectives.

OBSERVATION CHECKLIST

Perceived level of accuracy of commercially available keychain microscope kits in the peripheral blood smear (PBS) analysis

This section evaluates the accuracy of commercially available microscope kits compared to traditional compound microscopes in PBS analysis. Using the Likert scale below, please rate the accuracy of the microscope kits in observing the following aspects of cell morphology:

A. Using commercially available keychain microscope kits (Experimental) 1. Clarity of cell morphology with respect to:	1	2	3	4
a. Shape of cells				
b. Color of cells				
c. Stain (Wright stain)				
B. Using Traditional Compound Light Microscope (Control) 1. Clarity of cell morphology with respect to:				
a. Shape of cells				
b. Color of cells				
c. Stain (Wright stain)				

Rate	Description
1	Blood cells are not visible. No details about shape, color, and stain can be observed
2	Blood cells are barely visible. Shape, color, and stain appear distorted, making identification difficult.
3	Blood cells are visible. Shape, color, and stain are slightly distorted. Identification is possible with effort.
4	Blood cells are clear and accurately displayed with proper color, shape, and stain.

SURVEY QUESTIONNAIRE

Perceived level of practicability of the commercially available keychain microscope kits in the peripheral blood smear (PBS) analysis.

This section evaluates the perceived practicability of commercially available keychain microscope kits in educational settings. Using the Likert scale below, rate the level of practicability of commercially available keychain microscope kits in the following aspects:

Perceived level of practicability - commercially available keychain microscope kits (Experimental group)	1	2	3	4
1. Ease of Use				
2. Portability				
3. Cost-effectiveness				

Rate	Description
1	The microscope kit is difficult to use, hard to transport, and not cost-effective (expensive).
2	The microscope kit has is moderately difficult to use and transport; limited value for cost.
3	The microscope kit is fairly easy to use, portable, and offers a fair balance of cost and performance.
4	The microscope kit is easy to use, highly portable, and cost-effective, balancing price and performance.

RESOLUTION TEST

Perceived level of effectiveness of the commercially available keychain microscope kits in the peripheral blood smear (PBS) analysis.

This section evaluates the effectiveness of commercially available keychain microscope kits compared to traditional compound microscopes using specific parameters. Rate the level of performance in the following aspects:

Using Resolution Test	1	2	3	4
Experimental Group - Commercially available keychain microscope kits				
1. Contrast of details				
2. Sharpness of details				
3. Structural visibility of details				
Control Group - Traditional Compound Light Microscope				
1. Contrast of details				
2. Sharpness of details				
3. Structural visibility of details				

Rating	Description
1	Contrast, sharpness, and structural visibility are significantly poor, making the details indistinguishable.
2	Minimal contrast, sharpness, and structural visibility; details are visible but lack clarity or precision.
3	Acceptable level of contrast, sharpness, and structural visibility; details are discernible with some effort.
4	Excellent contrast, sharpness, and structural visibility; fine details are clearly visible and easily distinguishable.

Acknowledgment

Thank you for participating in this study. Your responses are valuable in advancing our understanding of the utility and effectiveness of commercially-available microscope kits. If you have additional comments or suggestions, please include them below:

Accomplished by: _____
(*Signature over Printed Name*)

Date: _____

APPENDIX O

Medical Result and Clearance of the Blood Donor



Connecting[™]
Healthcare
to Everyone





(Scan QR code to validate)
MEDICAL CERTIFICATE ID: 67FF017EE8658

Francis Bernardine G. Dadula, MD
General Practice
Dr. Francis Dadula Online Medical Clinic
Mariano Badelles Poblacion
Iligan City, Lanao Del Norte
Tel No.: 0906-521-1509

MEDICAL CERTIFICATE

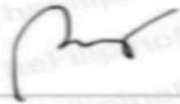
Patient:
Age:
Gender:

Complaints:
Certificate of Medical Fitness

Diagnosis:
Essentially normal findings at the time of the examination

Recommendation:
This is to certify that a resident of _____, was examined via telemedicine.

REMARKS: PHYSICALLY FIT
*CBC showed unremarkable results
*For confirmation, please contact
Email: francisdadula520@gmail.com or message at viber
This certificate is issued upon the request of the above patient for whatever purpose it may serve, except for medico-legal reasons.


Physician's Signature
PRC No.: 0155494
PTR No.: 6868687

(End of Medical Certificate)

Note to User:The information contained in this medical certificate are those of the prescriber and do not constitute as an endorsement of PPD Clinic. If any information is suspected to be manually or electronically altered, users are advised to scan the QR code to view the original contents of the medical certificate. The prescriber and the creators of the PPD App will not be liable for any loss or damage whatsoever arising from the use of altered or tampered medical certificates.

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125
'HT



Patient Name: _____
Ordering Physician: Walk-in
Patient Address: _____

Age: _____ Gender: _____
Date of Birth: _____
Date & Time Received: _____

COMPLETE BLOOD COUNT REPORT

Parameter	Result	Normal Range	Unit
White Blood Cells	4.9	5.0 - 10.0	$\times 10^9/L$
Red Blood Cells	5.0	M= 4.8 - 6.2 F= 4.2 - 5.4	$\times 10^{12}/L$
Hemoglobin	150	M= 140 - 180 F= 120 - 160	g/L
Hematocrit	48.2	M= 40 - 54 F= 37 - 47	%
Mean Corpuscular Volume	96.4	80 - 100	fL
Mean Corpuscular Hb.	32.7	25 - 32	pg
Mean Corpuscular Hb Conc.	317	320 - 330	g/L
RBC Distribution Width	11.7	11.6 - 14.6	%
Platelet	250	150 - 450	$\times 10^9/L$
Differential Count:			
Lymphocytes	46.4	25 - 40	%
Neutrophils	49.9	50 - 70	%
Monocytes	2.5	2 - 8	%
Eosinophils	1.2	1 - 4	%
Basophils	0.0	0 - 1	%

RESULT FLAGS: ▼LOW ▲HIGH METHOD USED: Automated Hematology Analyzer- HT100

URINALYSIS REPORT

Parameter	Result	Parameter	Result	Field
Color	Dark Yellow	Epithelial Cells	Few	/LPF
Turbidity	Hazy	Mucous Threads	Few	/LPF
Specific Gravity	1.030	Pus Cells	0 - 3	/HPF
pH	6.0	RBC	0 - 2	/HPF
Ketone	Negative	Bacteria	Few	/HPF
Protein	Negative	Amorph. Urates	Few	/LPF
Glucose	Negative	Crystals		/HPF
Urobilinogen	Normal	Casts		/LPF
Bilirubin	Negative	Yeast Cells		/HPF
Nitrite	Negative			
Leukocyte	Negative			
Blood	Negative			

FECALYSIS REPORT

Parameter	Result	Parameter	Result	Field
Color	Yellow Brown	RBC	0-2	/HPF
Consistency	Soft	WBC	0-2	/HPF
		Parasites	No Intestinal Parasite Seen	/HPF

SEROLOGY REPORT

Parameter	Result	Parameter	Result
HbsAg		Pregnancy Test(Urine)	
HAV IgM	Nonreactive		

METHOD USED: RAPIDQUE- Rapid Immunochromatographic Assay

Specimen Re-checked and Results Verified

This lab report is intended to be interpreted by a qualified medical doctor in conjunction with clinical evaluation and other diagnostic procedures.

Reported by:
Therese G. Gable, MD, JHDF
Pathologist | License No. 0134112

Reported by:
Richard B. Williams, RMT
Medical Technologist | License No. 0090470

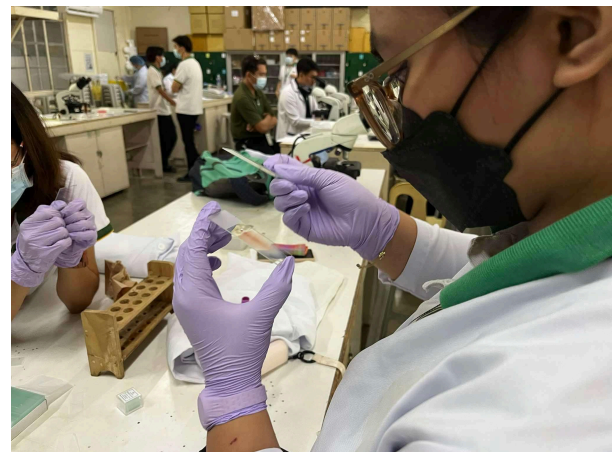
Validated By:
Queen A. Williams, RMT
Chief Medical Technologist | License No. 0104162

APPENDIX P

Photo Documentations



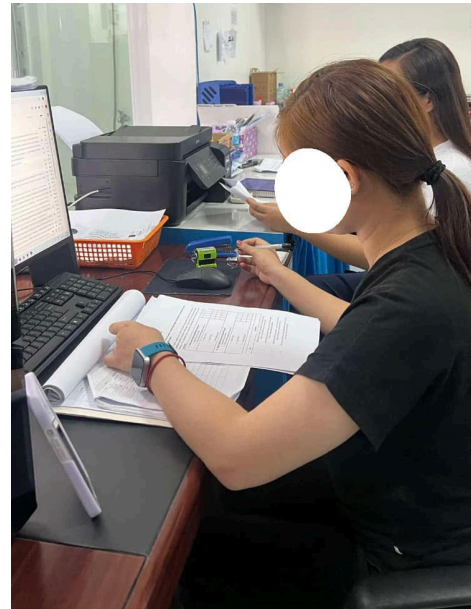
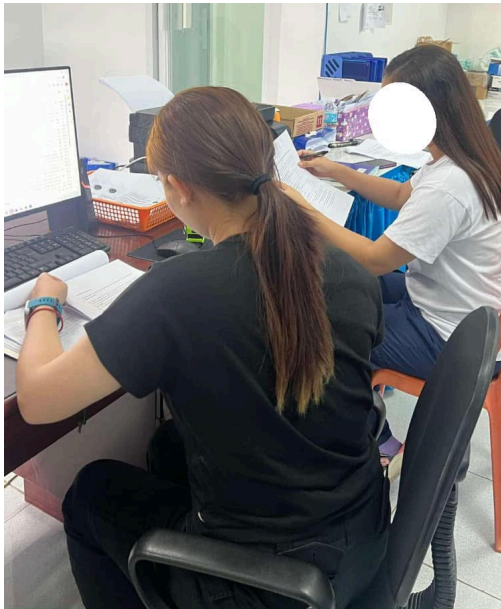
During the blood collection, the specimen was drawn using a 5cc syringe and transferred into an EDTA tube. The tube was immediately inverted 8 to 10 times to ensure thorough mixing of the blood with the anticoagulant, preventing clot formation.



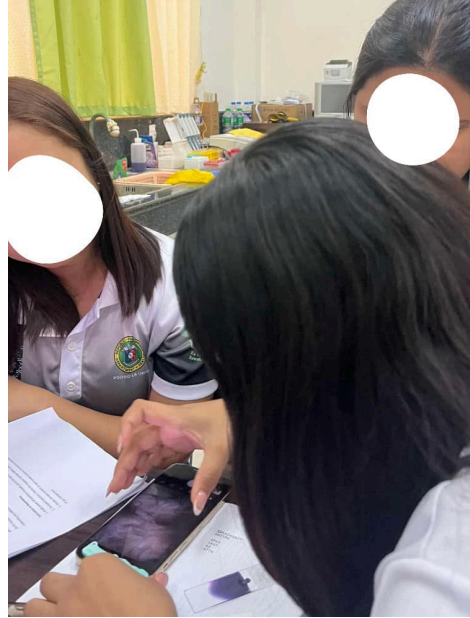
After the blood was collected, a small drop was placed onto a clean glass slide and immediately spread out using another clean slide at a 30 to 45-degree angle to create a thin and even layer.



Following the preparation of the blood smear, the slide was stained using Wright's stain for approximately 5 minutes to allow staining and fixation. Following this, the slide was gently rinsed with running water to remove excess stains from the slide. Immediately after rinsing the slide, a buffer solution was added to the smear, allowing it to react for 3 minutes. The slide was then gently rinsed with running water to remove the remaining stain and buffer. Finally, the slide was allowed to air-dry completely.



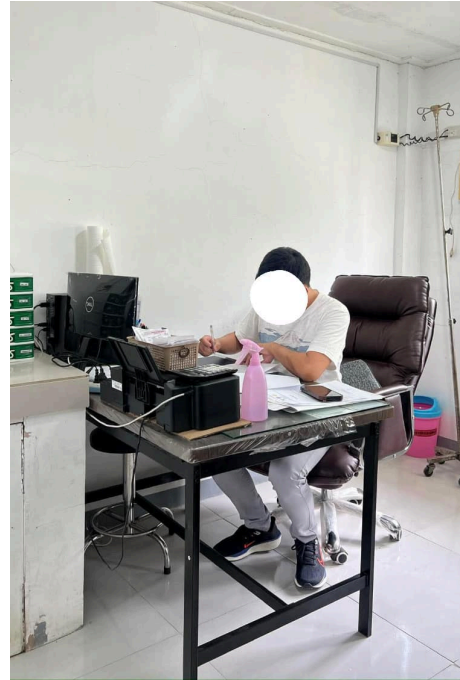
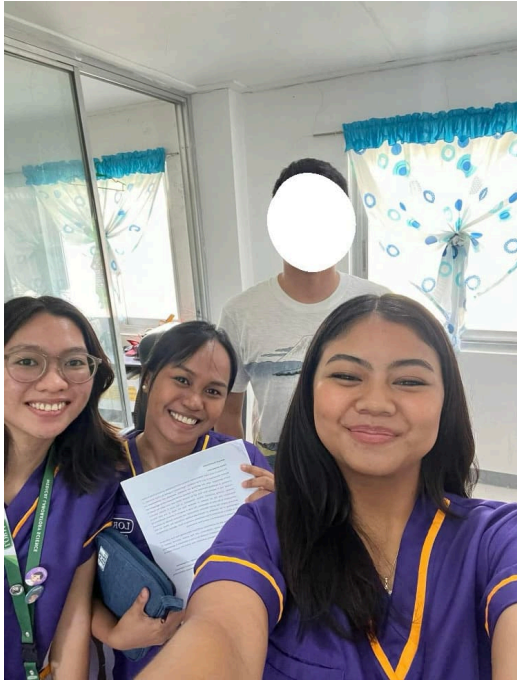
Data Gathering at MHU - Bacnotan, La Union



Data Gathering at MHU - Balaoan, La Union



Data Gathering at MHU - Bangar, La Union



Data Gathering at MHU - Santol, La Union



Data Gathering at MHU - San Gabriel, La Union



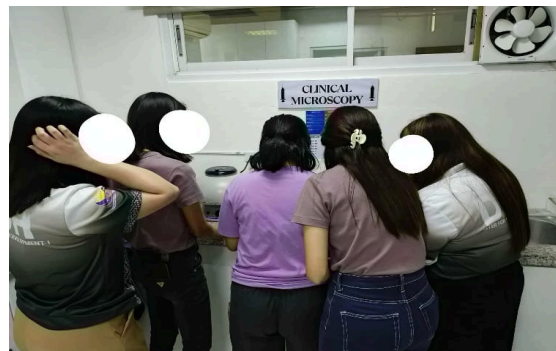
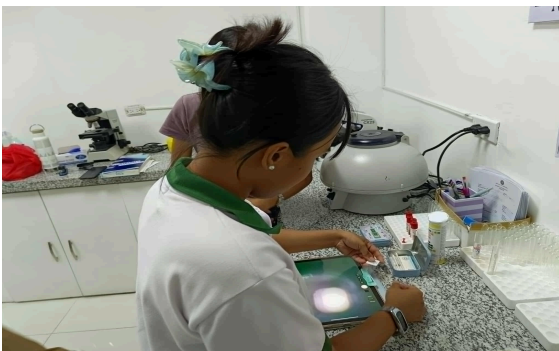
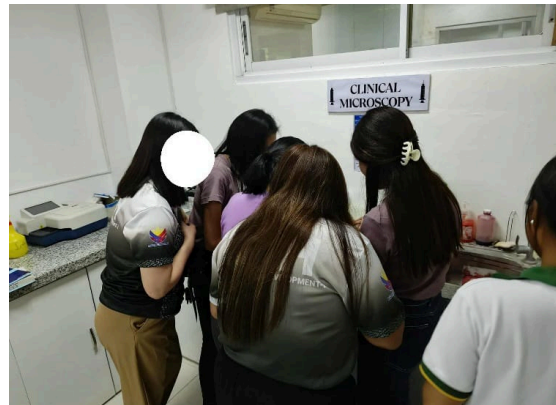
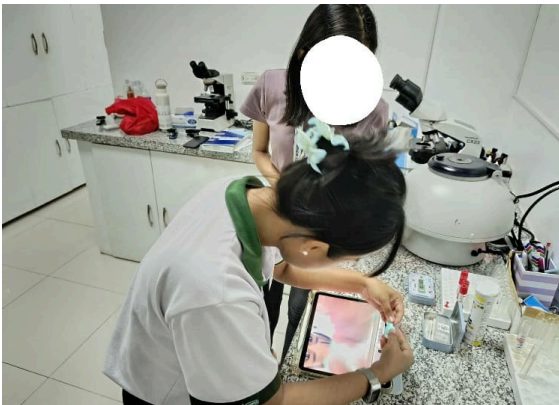
Data Gathering at MHU - Santo Domingo, Ilocos sur



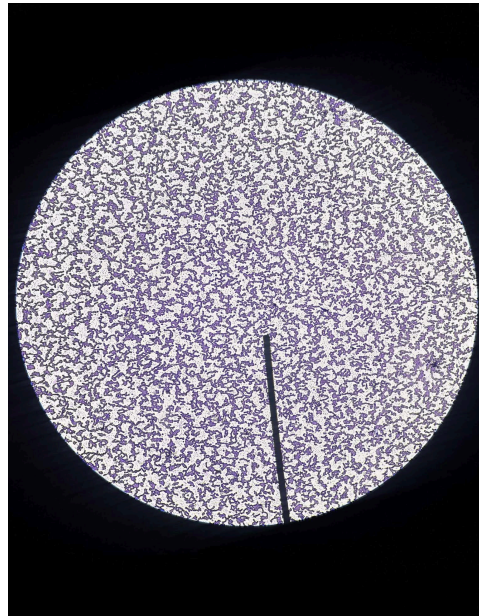
Data Gathering at PNP - Vigan City, Ilocos Sur



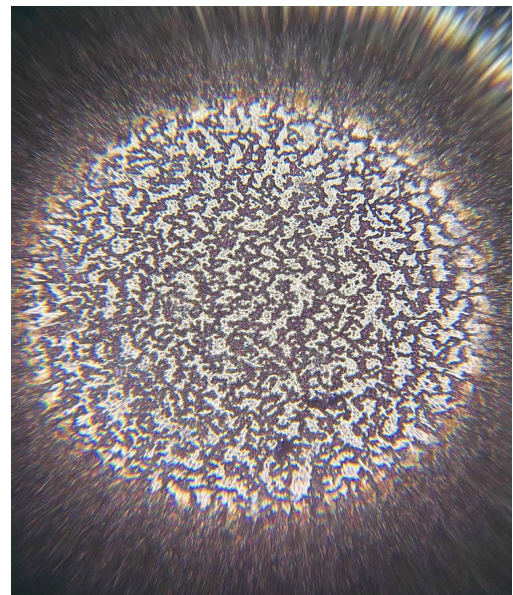
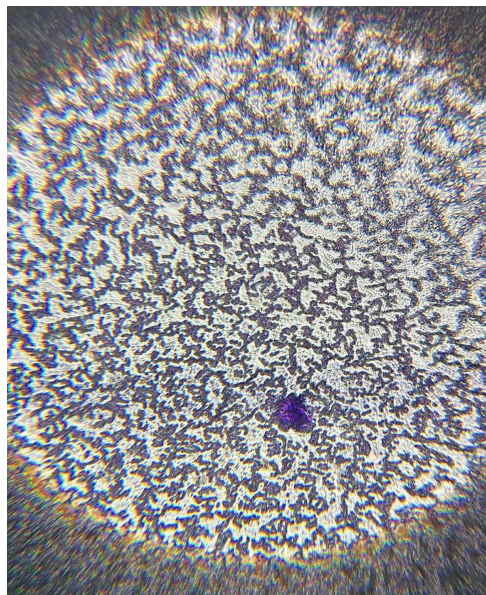
Data Gathering at Metro Vigan Cooperative Hospital



Data Gathering at MHU - City of San Fernando



Traditional Compound Microscope



Commercially Available Keychain Microscope

Comparison of Peripheral Blood Smear

(Commercially Available Keychain Microscope vs Traditional Compound Microscope)

APPENDIX Q

General Research Timetable



LORMA COLLEGE OF MEDICAL LABORATORY SCIENCE
Center for Health Sciences, Carlatan, City of San Fernando, La Union, Philippines,
2500 Facebook: @LormaCMLS | E-mail: cmls@lorma.edu



Title of the study: *Makecroscope: Accuracy and Practicability of Commercially Available Keychain Microscopes*

Proponent/s: Jeanne Princess D. Aquino, Angeli Jeah V. Comilang, Michaela Luisa A. Flordelis, Irish Nicole C. Ponce, Venice Jane M. Talavera, and April Joy L. Villanueva (LORMA College of Medical Laboratory Science)

Timetable	Research Task	Status
August 22, 2024 - September 08, 2024	- Formulation of Three Research Title Proposal - Recognition of research gaps and objectives - Literature Review - Theoretical and Conceptual framework - Survey and validation of research methodologies to be performed - Presentation of Research Titles - Revision of Titles	Completed
September 09, 2024 - Sep 13, 2024	- Approval of Final Research Topic - Presentation of revised research titles - Checking of titles for approval - Final decision on chosen research topic - Appointment of a Research Adviser	Completed
October 07, 2024 - October 14, 2024	- Accomplishment of Chapter 1 - Research on background of the study and review of related literature - Accomplishment of Chapter 2 - Formulation of research design - Recognition of population and locale of the study	Completed
October 14, 2024	- Initial Review of Chapter 1 and 2 - Submission of manuscript to research instructor for checking	Completed
October 15, 2024 - October 16, 2024	- Revision of Chapter 1 and 2 - Compliance of corrections, comments, and suggestions of the research instructor/adviser	Completed
October 17, 2024	- Review of Chapter 1 and 2 - Submission of manuscript to research instructor/adviser for checking - Secondary review of chapter 1 and 2	Completed



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October 18, 2024 - October 21, 2024	- Revision of Chapter 1 and 2 - Compliance of corrections, comments, and suggestions of the research instructor/adviser - Appointment of Research Statistician	Completed
October 21, 2024	- Third Review of Chapter 1 and 2 - Submission of manuscript to research instructor/adviser for checking	Completed
October 22, 2024 - November 28, 2024	- Revision of Chapter 1 and 2 - Compliance of corrections, comments, and suggestions of the research instructor/adviser - Letter to Advisers - Preparation of letter to advisers - Signing of letter to advisers	Completed
November 29, 2024 - November 30, 2024	- Review of Proposal Paper - Submission of manuscript to research instructor/adviser for checking	Completed
December 01, 2024- December 05, 2024	- Appointment of Research Statistician - Checking of manuscript by research statistician - Revision of Chapter 1 and 2 - Compliance of corrections, comments, and suggestions of the research instructor/adviser	Completed
December 05, 2024	- Submission of Final Research Proposal Paper - Submission of research proposal paper to research panel	Completed
December 09, 2024	Defense Proper	Completed
December 11, 2024 - December 23, 2024	- Revision of Research Paper - Compliance to corrections, comments, and suggestions of the research panel - Inquiry to Municipal Health Units of First Congressional District, specifically Bangar, Luna, Balaoan, Santol, Bacnotan, San Gabriel, San Juan, City of San Fernando, and Santo Domingo, Ilocos Sur, as well as at the La Union Medical Diagnostic Center and Hospital, Inc. (LUMED); the Philippine National Police (PNP) - Vigan City, Ilocos Sur; and Metro Vigan Cooperative Hospital. - Construction of Letters of Communication to the hospitals - Letters of Communication are signed by the researchers, dean, and research adviser to be delivered to the respected addresses.	Completed



January 17, 2025- January 22, 2025	1. Preparation of documents for REC review	Completed
January 21, 2025	1. Submission of Revised Research Paper and Compliance Report	Completed
January 23, 2025	1. Application for REC review	Completed
January 31, 2025	1. Participant Recruitment ● Sending formal invitations and consent forms to participants	Completed
February 05, 2025	1. Confirmation of Participants	Completed
February 06, 2025	1. Purchase of Materials for Data Gathering Procedures ● Purchase of microscope kits from Shopee (Jeremake)	Completed
February 14, 2025 -February 27, 2025	1. Letter of Communication to the Laboratory Custodian of the College of Medical Laboratory Science (CMLS) ● Inquire and construct a letter of request for assistance by the provision of laboratory materials.	Completed
March 05, 2025	1. Assembly and preliminary quality checks of microscope kits	Completed
March 07, 2025	1. Recruitment of Participant for Blood Collection ● Initial screening enlisting of donor for blood collection 2. Medical Clearance of Donor ● Donor undergoes medical evaluation and clearance by a physician, and obtain consent for blood donation 3. Follow up Letter of Communication to Ilocos Training and Regional Medical Center (ITRMC), LORMA Medical Center (LMC), La Union Medical Diagnostic Center and Hospital, Inc. (LUMED)	Completed
	1. Preparation of Peripheral Blood Film ● Preparation of peripheral blood smears ● Quality assurance checks on prepared smears	Completed
March 08, 2025 - March 12, 2025	1. Letter for Reliability Testing and Validity Testing ● The research tools were subjected to validity and reliability testing to establish their appropriateness and dependability for use in the study.	Completed
March 12, 2025	1. LC-REC Form Progress Report Form ● Edit the progress Report 2	Completed
March 13, 2025 - April 14, 2025	1. Letter for Reliability Testing and Validity Testing ● The research tools were subjected to validity and reliability testing to establish their appropriateness and dependability for use in the study. 2. Data Gathering ● Flootation of questionnaires to all Municipal Health Units	Completed



April 12, 2025 - April 14, 2025	- Continuation of editing the manuscript - Consultation with the Statistician	Completed
April 14, 2025	- Review of Research Manuscript - Submission of manuscript to research instructor for checking	Completed
April 22, 2025	Final Defense	Completed
April 23, 2025 - April 25, 2025	Revisions of Manuscript	Completed
May 02, 2025	Letter of Deviation to REC	Completed
May 07, 2025	Approval of Letter of Deviation	Completed
May 09, 2025	Final Revisions of Manuscript	Completed
May 14, 2025	Final Report to REC	Completed
May 23, 2025	Submission of Bound and Fully-signed Manuscript	Completed

APPENDIX R

Plagiarism Checker

**grammar chapter 1**

Goals98 Overall score

MAKECROSCOPE: ACCURACY AND PRACTICABILITY OF
COMMERCIALY AVAILABLE KEYCHAIN
MICROSCOPE

Jeanne Princess D. Aquino
Angeli Jeah V. Comilang
Michaela Luisa A. Fiordelis
Irish Nicole C. Ponce
Venice Jane M. Talavera
April Joy L. Villanueva

College of Medical Laboratory Science
LORMA Colleges - Center for Health Sciences
Carlatan, City of San Fernando, La Union

Register of Colleges in Medical Laboratory Science

 Formatting tools are not available.5,282 words ^

 Review suggestions

 Write with generative AI

 Check for AI text & plagiarism

**No plagiarism or AI text detected**

Your document doesn't match anything in our references or contain common AI text patterns.

[See all suggestions](#)

Chapter I

**grammar chapter 2**

Goals87 Overall score

CHAPTER II
METHODOLOGY
Research Design

The study employed a quantitative quasi-experimental design, which, according to Christensen et al. (2020), is appropriate for evaluating interventions in naturally existing groups without random assignment. This design assessed the accuracy, practicability, and effectiveness of commercially available keychain microscopes compared to traditional compound microscopes in educational settings, specifically for peripheral blood smear (PBS) analysis.

Using purposive sampling, the study involved fifty (50) Registered Medical Technologists and pathologists with at least one year of experience using traditional microscopes for PBS. Each participant examined the same PBS sample using both microscope types. Accuracy was evaluated based on color, shape, and Wright stain, while effectiveness was rated through contrast, sharpness, and structural visibility. These variables were assessed using a Likert scale, which is

 Formatting tools are not available.4,073 words ^

 Review suggestions

 Write with generative AI

 Check for AI text & plagiarism

**No plagiarism or AI text detected**

Your document doesn't match anything in our references or contain common AI text patterns.

[See all suggestions](#)

Chapter II

grammar chapter 3

Goals
89 Overall score

Review suggestions
Write with generative AI
Check for AI text & plagiarism

CHAPTER III

RESULTS AND DISCUSSION

This chapter presented and interpreted the study's findings, which aimed to evaluate the accuracy, practicability, and effectiveness of a commercially available keychain microscope for educational use, specifically in analyzing peripheral blood smears (PBS).

A total of 50 respondents participated in the study, consisting of 47 Registered Medical Technologists (RMTs) and three pathologists. The chapter is structured according to the study's main objectives: (1) to assess the accuracy of cell morphology observation; (2) to evaluate the perceived practicability of the keychain microscope in terms of ease of use, portability, and cost-effectiveness; (3) to determine the effectiveness of the microscope in terms of contrast, sharpness, and structural visibility; and (4) the thematic analysis of trends related to the commercially available keychain microscope.

Quantitative data were analyzed using descriptive statistics (mean, range, and inferential statistics, particularly paired t-tests, to compare responses).

Formatting tools are not available.

2,777 words

Chapter III

Grammar chapter 4

Goals
93 Overall score

Review suggestions
Write with generative AI
Check for AI text & plagiarism

CHAPTER IV

CONCLUSIONS AND RECOMMENDATIONS

This chapter summarizes the study and the results obtained from the data gathering and collection. Based on these results, conclusions are drawn. Recommendations are provided regarding utilizing commercially available keychain microscopes, particularly in institutions with limited access to laboratory equipment.

Summary of Findings

This study was conducted in various diagnostic and health institutions within the First Congressional District of the Province of La Union and parts of Ilocos, Sur. Specifically, data were gathered from the Municipal Health Units (MHUs) of Bacnotan, Balaoan, Bangar, City of San Fernando, Luna, San Gabriel, San Juan, Santol, and Santo Domingo, Ilocos Sur. Additional sites included the La Union Medical Diagnostic Center and Hospital, Inc. (LUMED), the Philippine National Police (PNP) – Vigan City, and the Metro Vigan Cooperative Hospital. Employing a quantitative research design, the study evaluated the accuracy and effectiveness of the keychain microscope in analyzing peripheral blood smears (PBS).

Formatting tools are not available.

1,856 words

Chapter IV

APPENDIX S

Grammar Checker

Performance

Text score: 98 out of 100. This score represents the quality of writing in this document. You can increase it by addressing Grammarly's suggestions.

98

Word count

Characters **40,814**

Words **5,276**

Sentences **314**

Reading time **21 min 6 sec**

Speaking time **40 min 35 sec**

Readability

Metrics compared to other Grammarly users

Word length **6.1**

 Above average

Sentence length **16.8**

 Above average

Readability score **12** ⓘ

Your text is likely to be understood by college graduates but may not be easy for many to read.

Vocabulary

Metrics compared to other Grammarly users

Unique words **24%** ⓘ

 Below average

Rare words **44%** ⓘ

 Below average

Chapter I

Performance

Text score: 92 out of 100. This score represents the quality of writing in this document. You can increase it by addressing Grammarly's suggestions.

92

Word count

Characters **29,169**

Words **4,057**

Sentences **294**

Reading time **16 min 13 sec**

Speaking time **31 min 12 sec**

Readability

Metrics compared to other Grammarly users

Word length **5.9**

 Above average

Sentence length **13.8**

 Above average

Readability score **22** ⓘ

Your text is likely to be understood by college graduates but may not be easy for many to read.

Vocabulary

Metrics compared to other Grammarly users

Unique words **22%** ⓘ

 Below average

Rare words **48%** ⓘ

 Below average

Chapter II

Performance

Text score: 95 out of 100. This score represents the quality of writing in this document. You can increase it by addressing Grammarly's suggestions.

95

Word count

Characters	20,643	Reading time	11 min 6 sec
Words	2,775	Speaking time	21 min 20 sec
Sentences	212		

Readability

Metrics compared to other Grammarly users

Word length	6.1		Above average
Sentence length	13.1		Above average
Readability score	18 ⓘ		

Your text is likely to be understood by college graduates but may not be easy for many to read.

Vocabulary

Metrics compared to other Grammarly users

Unique words	22% ⓘ		Below average
Rare words	42% ⓘ		Below average

Chapter III

Performance

Text score: 96 out of 100. This score represents the quality of writing in this document. You can increase it by addressing Grammarly's suggestions.



Word count

Characters	10,900	Reading time	5 min 32 sec
Words	1,387	Speaking time	10 min 40 sec
Sentences	67		

Readability

Metrics compared to other Grammarly users

Word length	6.7		Above average
Sentence length	20.7		Above average
Readability score	-7 ⓘ		

Your text is likely to be understood by college graduates but may not be easy for many to read.

Vocabulary

Metrics compared to other Grammarly users

Unique words	36% ⓘ		Below average
Rare words	45% ⓘ		Below average

Chapter IV

APPENDIX T

Statistician Certificate



LORMA COLLEGE OF MEDICAL LABORATORY SCIENCE
Carlatan, City of San Fernando, La Union, Philippines, 2500
Facebook: @LormaCMLS | E-mail: cmls@lorma.edu



CERTIFICATION

This is to certify that the research entitled **"MAKECROSCOPE: ACCURACY AND PRACTICABILITY OF COMMERCIALLY AVAILABLE KEYCHAIN MICROSCOPE"** by Jeanne Princess D. Aquino, Angeli Jeah V. Comilang, Michaela Luisa A. Flordelis, Irish Nicole C. Ponce, Venice Jane M. Talavera, and April Joy L. Villanueva, third year students taking the degree Bachelor of Medical Laboratory Science of LORMA Colleges, have been checked and statistically analyzed by the undersigned.

This certification is issued to ensure that the institution received quality research work. Signed
this 14th day of April 2025.


SHARI MARO R. RAPOSAS, EdD
Statistician

APPENDIX U

Contract of Acceptance for Faculty Adviser

	LORMA COLLEGE OF MEDICAL LABORATORY SCIENCE Carlatan, City of San Fernando, La Union, Philippines, 2500 Facebook: @LormaCMLS E-mail: cmls@lorma.edu	
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Contract of Acceptance for Faculty Research Adviser

Choosing a research topic and finding an adviser are clearly linked, although, the first precedes the second. The competency and passion of Research Advisers parallel the successful completion of the research initiative.

As per the current standing CMLS Research Manual, only bona fide employees of the LORMA Colleges may be assigned as Research Advisers by the Research Coordinator and Instructor, with the approval of the office of the Dean. Priority for research paper advising will be given to full-time faculty members of the College.

Every member of the faculty must handle at least one (1) research group per Academic Year. A maximum of five (5) groups can be handled by a Faculty Research Adviser to ensure the quality of the outputs.

Lastly, the Faculty Adviser's research interests, expertise, experiences, previous research works/publications, as well as their acceptance, credence, and initiative to help must be considered.

Responsibilities of the Faculty Research Advisers

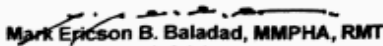
Research is one of the pillars of higher education, alongside instruction and extension. Therefore, it is imperative for faculty members to engage in research activities which would contribute to the current pool of knowledge in the field of medical laboratory science, public health, allied health education, and other related fields.

1. Formulate general and specific questions and decide of the overall direction of the study proposed by the student.
2. Input ideas, monitor, and supervise the progress of the paper.
3. Help resolve group disputes or conflicts and unify the group.
4. Extensively and substantially assist on the data gathering procedure (either during interview, dissemination of questionnaires, experimentation) in Research 2 and writing of the manuscript.
5. Minimize the risk of the study to the research participants by stringently ensuring that all legal and ethical principles are followed and implemented as prescribed by institutional research standards.
6. Contribute on the revisions based on the suggestion and recommendations by the Research Technical Panel and partner institution (if present).
7. Check the completeness, accuracy, validity, and rigor of methodology to be employed and the data gathered.
8. Attend on the proposal and final defense schedules and clarify concepts to the Research Defense Panel if asked to intervene.
9. Obligated to oversee the research paper even after defense (for publication and participation in various fora or academic conferences).

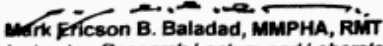
I understand all the terms and conditions stated herein.

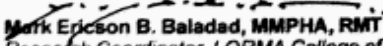
Therefore, I fully accept the duties and responsibilities inherent to becoming a Faculty Research Adviser for the research entitled: **"Exploring the Laboratory Practicability and Utilization of Commercially-Available Microscope Kits"**

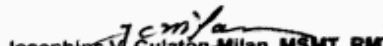
Conformed:


Mark Ericson B. Baladad, MMPHA, RMT
Faculty Research Adviser
Date: 9/10/2024

Noted by:


Mark Ericson B. Baladad, MMPHA, RMT
Instructor, Research Lecture and Laboratory


Mark Ericson B. Baladad, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science


Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science

10. Authors' Biography



LC-REC Form #003
CV TEMPLATE

CURRICULUM VITAE



AQUINO, JEANNE PRINCESS D.

I. PERSONAL INFORMATION

Address : Gabao, Santiago, Ilocos Sur
Contact Number : 09273039805
Email add : jeanneprincess.aquino@lorma.edu
Date of Birth : December 02, 2003
Place of Birth : Gabao, Santiago, Ilocos Sur

II. EDUCATIONAL BACKGROUND

Tertiary **Lorma Colleges, Bachelor Medical Laboratory Science**
Carlatan, City of San Fernando, La Union
2022 - Present

Secondary **Santiago Catholic School (Junior High School - Senior High School)**
Poblacion Sur, Santiago, Ilocos Sur
2016 - 2022

Primary **Gabao Elementary School**
Gabao, Santiago, Ilocos Sur
2015 - 2016

Cutud Elementary School
Cutud, Angeles City, Pampanga
2009 - 2015

III. AWARDS/CITATIONS/RECOGNITIONS RECEIVED

Tertiary Education	LORMA Colleges, College of Medical Laboratory Science <i>Academic Full Scholar Second Semester - 2022 - 2023</i>
Secondary Education	Santiago Catholic School <i>Citizenship Advancement Training Officer - 2019 - 2020</i>
Primary Education	Gabao Elementary School <i>Supreme Student Government - Treasurer 2015 - 2016</i>
	Cutud Elementary School <i>Supreme Student Government President 2015 - 2016</i>

IV. WORK EXPERIENCE : N/A

V. ELIGIBILITY: *First Aid Responder, Certified by Red Cross La Union Chapter (2023)*

VI. SEMINARS ATTENDED

First Aid Training, Red Cross La Union Chapter (2023)

KADALUBHASAAN Webinar Series (2024)

VII. INVOLVEMENT IN RESEARCH/RESEARCHES CONDUCTED

Panukala Para sa Bayanihan sa Paglilinis ng Kapaligiran sa Barangay Gabao, Author (2020)

The Impacts of Mobile Gaming on the Social Behavior of Grade 12 Students of Santiago Catholic School Author (2021)

The Effectiveness of Alternative Backpack Sprayer Out of Recycled Materials Co-author (2022)



CURRICULUM VITAE



COMILANG, ANGELI JEAH V.

I. PERSONAL INFORMATION

Address : Poblacion, Bacnotan, La Union
Contact Number : 09158309186
Email add : angelijeah.comilang@lorma.edu
Date of Birth : October 31, 2004
Place of Birth : Ilocos Training and Regional Medical Center

II. EDUCATIONAL BACKGROUND

Tertiary **Lorma Colleges, Bachelor Medical Laboratory Science**
Carlattan, City of San Fernando, La Union
2022 - Present

Secondary **Lorma Senior High School**
Urbiztondo, San Juan, La Union
2020 - 2022

Bacnotan National High School (Junior High School)
Poblacion, Bacnotan, La Union
2016 - 2020

Primary **Zaragosa Integrated School**
Zaragosa, Bacnotan, La Union
2009 - 2016

III. AWARDS/CITATIONS/RECOGNITIONS RECEIVED

Tertiary Education	LORMA Colleges, College of Medical Laboratory Science <i>Academic Half Scholar First Semester - 2022 - 2023</i> <i>Academic Dean's Lister Second Semester - 2022 - 2023</i>
Secondary Education	LORMA Senior High School <i>With Honors 2020 - 2021</i> <i>Citation in Research 2021 - 2022</i> <i>With High Honors 2021 - 2022</i> Bacnotan National High School (Junior High School) <i>With Honors 2016 - 2017</i> <i>With Honors 2017 - 2018</i> <i>With Honors 2018 - 2019</i> <i>With High Honors 2019 - 2020</i>
Primary Education	Zaragosa Integrated School <i>Class Valedictorian 2015 - 2016</i> <i>Supreme Student Government President 2015 - 2016</i> <i>With Honors 2014 - 2015</i> <i>With Honors 2013 - 2014</i> <i>With Honors 2012 - 2013</i> <i>With Honors 2011 - 2012</i> <i>With Honors 2010 - 2011</i>

IV. WORK EXPERIENCE: N/A

V. ELIGIBILITY: *First Aid Responder, Certified by Red Cross La Union Chapter (2023)*

VI. SEMINARS ATTENDED

First Aid Training, Red Cross La Union Chapter (2023)

KADALUBHASAAN Webinar Series (2024)

VII. INVOLVEMENT IN RESEARCH/RESEARCHES CONDUCTED

Lumpia Wrapper Fortified with Squash (Cucurbita maxima), Co-author (2020)

Scrutinizing the Impact of Work From Home on Filipino Teachers Amidst the COVID-19 Pandemic, Co-author (2022)

Assessing the Impact of Soil-Transmitted Helminth Infections: Prevalence and Control of Ascaris lumbricoides in Rural Communities, Co-author (2025)



CURRICULUM VITAE



FLORDELIS, MICHAELA LUISA A.

I. PERSONAL INFORMATION

Address : #81 Gapuz Zigzag Road, Barangay II, City of San Fernando, La Union
Contact Number : 09663145595
Email add : michaelaluisaa@gmail.com
Date of Birth : July 21, 2003
Place of Birth : ITRMC, City of San Fernando, La Union

II. EDUCATIONAL BACKGROUND

Tertiary **LORMA Colleges, College of Medical Laboratory Science**
Barangay Carlatan, City of San Fernando, La Union
2022 - Present

Saint Louis University
Baguio City
2021-2022

Secondary **CICOSAT Colleges, Junior High School**
Lingsat, City of San Fernando, La Union
2015-2019

La Union National High School, Senior High School
Barangay Catbangan, City of San Fernando, La Union
2019-2021

Primary **San Fernando North Central School**
Barangay Tanqui, City of San Fernando, La Union

III. AWARDS/CITATIONS/RECOGNITIONS RECEIVED

Secondary

CICOSAT Colleges, Junior High School

Academic Achiever (With Honors) 2015-2019

Student Body Organization - Class Representative

2015-2017

La Union National High School - Senior High School

Academic Achiever (With Honors) 2019 - 2020

Academic Achiever (With Honors) 2020 - 2021

Primary

North Central School

With Honors 2014 - 2015

IV. WORK EXPERIENCE

KAPELLA (Barista) - 2023 - 2024

Sangguniang Kabataan Chairperson - 2024 to present

V. ELIGIBILITY: N/A

VI. SEMINARS ATTENDED:

KADALUBHASAAN Webinar Series (2024)

Basic Life Support Training (2025)

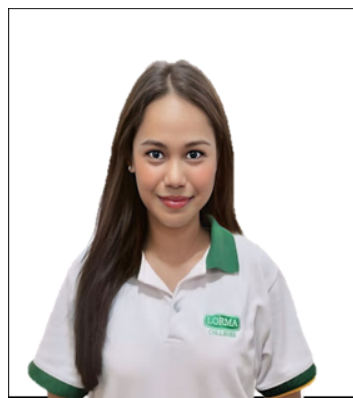
VII. INVOLVEMENT IN RESEARCH/RESEARCHES CONDUCTED:

LUNHS Research Colloquium (1st place) - 2020

Banana Peels (Musa Acuminata) as an Alternative Way on Making a Charcoal Co Author (2020)



CURRICULUM VITAE



PONCE, IRISH NICOLE C.

I. PERSONAL INFORMATION

Address : Ballay, Bauang, La Union
Contact Number : 09166429573
Email add : irishnicole.ponce@lorma.edu
Date of Birth : November 1, 2004
Place of Birth : Ilocos Training and Regional Medical Center

II. EDUCATIONAL BACKGROUND

Tertiary **Lorma Colleges, Bachelor Medical Laboratory Science**
Carlatan, City of San Fernando, La Union
2022 - Present

Secondary **Don Mariano Marcos Memorial State University-MLUC**
(Senior High School)
Quezon Ave, City of, San Fernando, La Union
2020 - 2022

La Union Colleges of Science and Technology Inc. (Junior
High School)
Central West, Bauang, La Union
2016 - 2020

Primary **Ballay Elementary School**
Ballay, Bauang, La Union
2009 - 2016

III. AWARDS/CITATIONS/RECOGNITIONS RECEIVED

Tertiary Education	LORMA Colleges, College of Medical Laboratory Science <i>Academic Full Scholar First Semester - 2022 - 2023</i> <i>Academic Half Scholar Second Semester - 2022 - 2023</i>
Secondary Education	Don Mariano Marcos Memorial State University-MLUC (Senior High School) <i>With Honors 2020 - 2021</i> <i>With Honors 2021 - 2022</i> La Union Colleges of Science and Technology Inc. (Junior High School) <i>With Honors 2016 - 2017</i> <i>With High Honors 2017 - 2018</i> <i>With High Honors 2018 - 2019</i> <i>With High Honors, Class Valedictorian 2019 - 2020</i>
Primary Education	Ballay Elementary School <i>Class Salutatorian 2015 - 2016</i> <i>Supreme Student Government President 2015 - 2016</i> <i>Supreme Student Government - Division Treasurer 2015 - 2016</i>

IV. WORK EXPERIENCE: N/A

V. ELIGIBILITY: *First Aid Responder, Certified by Red Cross La Union Chapter (2023)*

VI. SEMINARS ATTENDED

Fighting Vaccine Misinformation Webinar (2022)

First Aid Training, Red Cross La Union Chapter (2023)

Rizal: His Humanity, Extraordinariness, and Godlike Visions by ICON Review and Training Center (2024)

KADALUBHASAAN Webinar Series (2024)

VII. INVOLVEMENT IN RESEARCH/RESEARCHES CONDUCTED

Parental Involvement on Modular Learning Modality, Co-author (2020)

Toward Eradicating River Blindness: Investigating Epidemiology, Treatment, and Public Health Barriers In Onchocerca volvulus Control, Co-author (2025)

Deworming Campaign Participation Among Children From High STH Prevalence Area: An Assessment of Local Public Health System Delivery, Co-author (2025)



CURRICULUM VITAE



TALAVERA, VENICE JANE M.

I. PERSONAL INFORMATION

Address : Cabaroan (Negro), City of San Fernando, La Union
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Email add : venicejane.talavera@lorma.edu
Date of Birth : June 25, 2004
Place of Birth : City of San Fernando, La Union

II. EDUCATIONAL BACKGROUND

Tertiary **Lorma Colleges, Bachelor Medical Laboratory Science**
Carlattan, City of San Fernando, La Union
2022 - Present

Secondary **Christ the King Colleges (Senior High School)**
Quezon Ave, City of San Fernando, La Union
2020-2022

Don Mariano Marcos Memorial State University-MLUC
(Junior High School)
Quezon Ave, City of San Fernando, La Union
2016-2020

Primary **North Central School**
Cabaroan, City of San Fernando, La Union
2009-2016

III. AWARDS/CITATIONS/RECOGNITIONS RECEIVED

Tertiary Education **LORMA Colleges, College of Medical Laboratory Science**

Academic Half Scholar First Semester - 2022 - 2023

Secondary Education **Christ the King College (Senior High School)**

With Honors 2020 - 2021

With Honors 2021 - 2022

IV. WORK EXPERIENCE: N/A

ELIGIBILITY: *First Aid Responder, Certified by Red Cross La Union Chapter (2023)*

VI. SEMINARS ATTENDED

First Aid Training, Red Cross La Union Chapter (2023)

KADALUBHASAAN Webinar Series (2024)

VII. INVOLVEMENT IN RESEARCH/RESEARCHES CONDUCTED

Toward Eradicating River Blindness: Investigating Epidemiology, Treatment, and Public Health Barriers In Onchocerca volvulus Control, Co-author (2025)



CURRICULUM VITAE



VILLANUEVA, APRIL JOY L.

I. PERSONAL INFORMATION

Address : Reyna Regente, Bangar, La Union
Contact Number : 09162823205
Email add : apriljoy.villanueva@lorma.edu
Date of Birth : April 24, 2004
Place of Birth : Ilocos Training and Regional Medical Center

II. EDUCATIONAL BACKGROUND

Tertiary Lorma Colleges, Bachelor Medical Laboratory Science

Carlatan, City of San Fernando, La Union
2022 - Present

Secondary Saint Christopher Academy (Senior High School)

Central East #1, Bangar, La Union
2020 - 2022

Saint Christopher Academy (Junior High School)

Central East #1, Bangar, La Union
2016 - 2020

Primary Saint Christopher Academy

Central East #1, Bangar, La Union
2009 - 2016

III. AWARDS/CITATIONS/RECOGNITIONS RECEIVED

Tertiary Education	LORMA Colleges, College of Medical Laboratory Science <i>Academic Full Scholar First Semester - 2022 - 2023</i> <i>Academic Dean's Lister Second Semester - 2022 - 2023</i>
Secondary Education	Saint Christopher Academy (Senior High School) <i>With High Honors 2020 - 2021</i> <i>With High Honors 2021 - 2022</i> <i>Supreme Student Government - Representative 2021-2022</i> Saint Christopher Academy (Junior High School) <i>With Honors 2017 - 2018</i> <i>With Honors 2018 - 2019</i> <i>With Honors 2019 - 2020</i> <i>Citizenship Advancement Training Officer - 2019 - 2020</i>

IV. WORK EXPERIENCE: N/A

V. ELIGIBILITY: *First Aid Responder, Certified by Red Cross La Union Chapter (2023)*

VI. SEMINARS ATTENDED

First Aid Training, Red Cross La Union Chapter (2023)

KADALUBHASAAN Webinar Series (2024)

VII. INVOLVEMENT IN RESEARCH/RESEARCHES CONDUCTED

The Effectiveness of Virtual Learning among Grade 11 Students at Saint Christopher Academy S.Y. 2021-2022, Co-author (2022)



MARK ERICSON B. BALADAD
Academic Medical Technologist

BIONOTE:

Within his five-year professional career, Mr. Baladad has gained backgrounds in medical laboratory science – particularly in clinical parasitology and microbiology, public health, medical research and ethics, allied health education, and healthcare management. Currently, he is the Assistant Dean of the College of Medical Laboratory Science, LORMA Colleges, La Union, Philippines.

I. PERSONAL INFORMATION:

Address	:	420 Romas Road, Barangay Paringao, Bauang, La Union 2501
Contact number	:	0948 077 7517
Personal e-mail address	:	sadmarkwrites@gmail.com
Work e-mail address	:	markericson.baladad@lorma.edu
Date of birth	:	February 1, 1998
Place of birth	:	ITRMC, City of San Fernando, La Union

II. EDUCATIONAL QUALIFICATION:

Graduate level:

- Philippine Christian University – *on-going* Doctor of Philosophy in International Healthcare Management (PhD-IHCM), Malate, Manila (*earned 33 units*)
- Hardam Furigay Colleges Foundation, Inc. – *on-going* Master of Arts in Education major in Educational Administration (MAEd) (*earned 27 units*)
- Philippine Christian University – completed Master in Management major in Public Health Administration (MMPHA), Malate, Manila
- Angeles University Foundation – *finished academic units for* Master of Science in Medical Laboratory Science (MSMLS), Angeles City

Post-baccalaureate level:

- Iqra Development Academy of Bangsamoro Administrative Region of Muslim Mindanao – Certificate in Professional Teaching (CPT), Tamparan, Lanao del Sur

Baccalaureate level:

- LORMA Colleges, Inc. – Bachelor of Science in Medical Laboratory Science (BSMLS), Carlatan, City of San Fernando, La Union
 - Successfully passed the Medical Technology Licensure Examination in March 2019

III. WORK EXPERIENCES:

Medical Laboratory Science Instructor

LORMA College of Medical Laboratory Science

08/2019 – Present

City of San Fernando, La Union

Achievements/Tasks:

- **College instructor (2019 – Present)**
 - Teaches professional/major and core subjects in medical laboratory science/technology
 - Previous course designation includes Clinical Parasitology, Clinical Microscopy, Research Writing, MLS Seminar I and II, Medical Technology Assessment Program I and II, Health Information Systems, Community and Public Health, Principles of Medical Laboratory Science, and Biochemistry
- **Research Coordinator (2020 – Present)**
 - Disseminate areas of research to the faculty, staff, and students in the College
 - Coordinate research activities within their respective departments
 - Prepare annual research journal and submits the same to the Chairman of Research
 - Prepare and submit annual reports on the research accomplishment of the department
 - Oversees the overall delivery of MLS Research to third year students
 - Serve as a contact person for external affiliation or research collaboration
- **Flexible Online Learning Coordinator (2020 – 2024)**
 - Attend meetings, trainings, and seminars for the HyFlex and Flexible learning program
 - Conducts survey to assess the delivery of the institutional learning modality
 - Provide technical assistance to the faculty and staff of the College
- **Academic Coordinator (2024)**
 - Oversee the academic operations of the College
 - Support and assist the Dean with student matters and concerns
- **Faculty Adviser, LORMA Colleges Red Cross Youth Council (2019 – Present)**
 - Oversees the overall operations and functions of the Council

IV. PROFESSIONAL ORGANIZATION:

Pinagpala Publishing Services, Inc.		
Editorial Board Member		
12/2022 – Present		<i>Philippines</i>
LORMA Colleges Research Ethics Committee (LC-REC)		
Reviewer/Member		
10/2022 – 2024		<i>Philippines</i>
Biorisk Association of the Philippines, Inc. (BRAP)		
Member		
7/2022 – Present		<i>Philippines</i>
International Society for Evolutionary Medicine and Public Health (ISEMPH)		
Gratis Member - User ID Number: 57661004		
1/2021 – Present		<i>Portugal</i>
International Association of Innovation Professionals (IAIP)		
Associate Member - User ID Number: 5265		
1/2021 – Present		<i>United States of America</i>
The Philippine Society of Parasitology, Inc. (PSP)		
Member - Region 1 Chapter		
11/2020 – Present		<i>Philippines</i>
LORMA Colleges – Red Cross Youth Council (LC-RCYC)		
Faculty Adviser		
8/2019 – Present		<i>Philippines</i>

The Microbiology Society

Affiliate Member - Membership Number: C028636

7/2019 – Present

United Kingdom

The Philippine Association for Medical Technologists, Inc. (PAMET)

Member – La Union Chapter

3/2019 – Present

Philippines

Philippine Association of Schools of Medical Technology and Public Health (PASMETH)

Member

3/2019 – Present

Philippines

IV. PUBLICATIONS:

Research projects (in-progress and finished):

- **Title:** Case report: soil-transmitted helminthiasis among school children in a mountainous community
Proponent/s: M. E. B. Baladad *et. al.*
Status: Pre-print
Publication date: May 2024
- **Title:** The association between hyperglycemia and pulmonary tuberculosis
Proponent/s: M. E. B. Baladad *et. al.*
Status: Completed (presented in PAMET Research Forum)
Publication date: September 2024
- **Title:** Entry-level competencies among LORMA College of Medical Laboratory Science graduates: meeting the demands and trends of the profession
Proponent/s: M. E. B. Baladad *et. al.*
Status: Completed (presented in PAMET Research Forum)
Publication date: September 2024
- **Title:** Knowledge, attitude and perception towards Human Papilloma Virus (HPV) vaccination among female commercial sex workers
Proponent/s: M. E. B. Baladad *et. al.*
Status: Completed (presented in 11th Huachiew Chalermprakiet University National and International Conference 2024, Thailand)
Publication date: August 2024
- **Title:** Prevalence and associated-risk factors of helminthiasis among learners of public elementary and high school of City of San Fernando, La Union
In partnership with: Department of Education – City Schools Division of San Fernando, La Union
Proponent/s: LORMA College of Medical Laboratory Science
Status: December 2022 (completed)
- **Title:** Java plum (*Syzygium cumini*) extract as an alternative stain for the modified Kato-katz technique
Proponent/s: M. E. B. Baladad
Status: For research proposal (on-going research)
Start date: August 2023
- **Title:** Graduate tracer study of LORMA Colleges batch 2016-2021
Proponent/s: M. E. B. Baladad, *et. al.*
Journal: LORMA Colleges Institutional Research Journal
Publication date: July 2023 (completed)

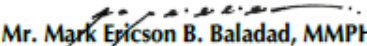
- An extensive and comprehensive compilation of review notes covering the three major branches of Medical Microbiology: Bacteriology, Mycology and Virology.

V. REFERENCES:

Josephine V. Culaton-Milan, MSMT, RMT
Dean LORMA College of Medical Laboratory Science
Contact detail: josephine.milan@lorma.edu

Marites C. Pagdilao, MAN, MPA, RN
Chair, LORMA Colleges CHS Graduate School and Research Institute
Contact detail: marites.pagdilao@lorma.edu

I hereby declare that all information provided is true and correct. I also understand that any willful dishonesty may render for refusal of this application or immediate termination of employment.


Mr. Mark Ericson B. Baladad, MMPHA, RMT, CPT
Medical Laboratory Science Instructor