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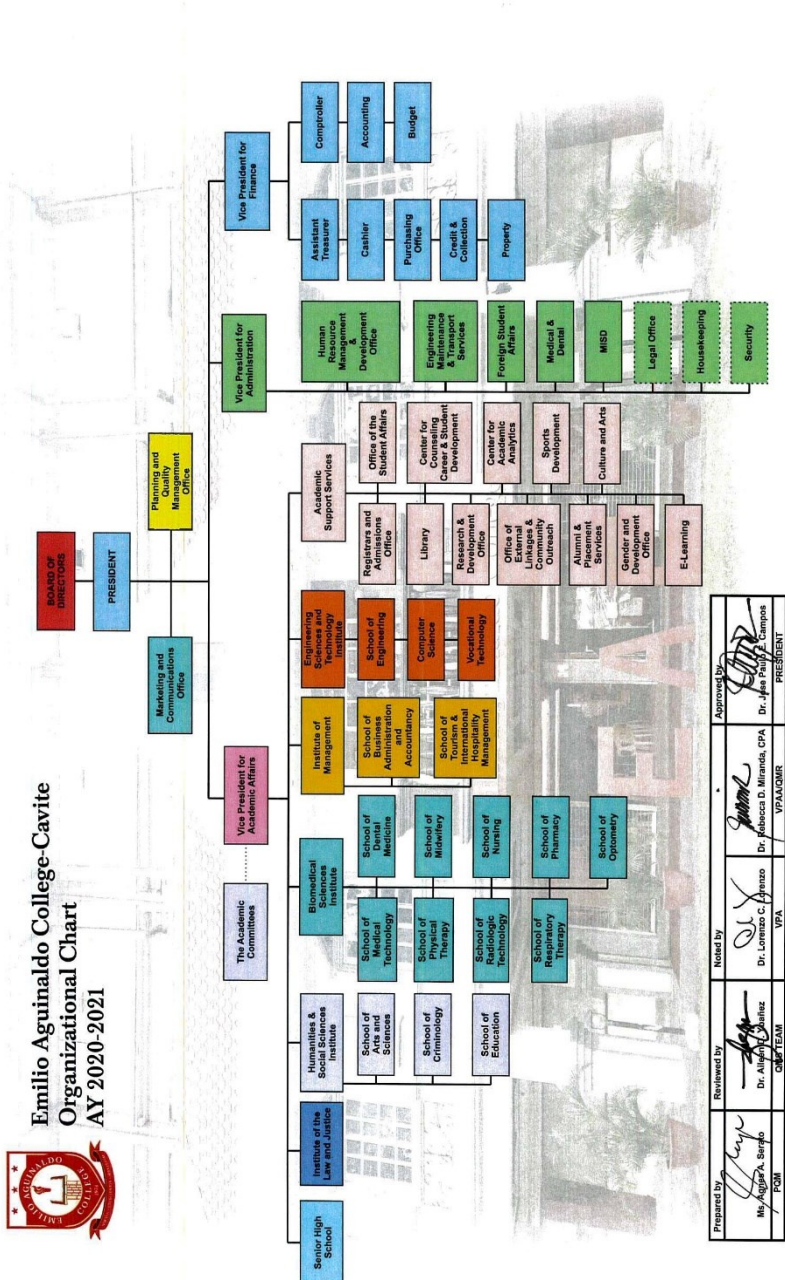
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# EAC ORGANIZATIONAL CHART



## **Brief History of Emilio Aguinaldo College**

The beginnings of Emilio Aguinaldo College - Cavite are attributed to Dr. Paulo C. Campos, then President of the University Physicians Services Incorporated (UPSI), which acquired the Marian College in Manila in 1973. Eventually, the school became Emilio Aguinaldo College.

With the various socio-economic developments and related circumstances during the Marcos regime, UPSI decided to open a new campus in Dasmariñas, Cavite, which is the hometown of Dr. Campos. This is to support the government's policy on the dispersal and decongestion of the student population in Metro Manila, particularly in institutions of higher learning. The policy also aimed to introduce regional development and democratization of opportunities in the rural areas (Campos, 2008).

Emilio Aguinaldo College in Bagong Bayan, Dasmariñas, Cavite was opened on March 17, 1978. Its opening coincided with the efforts of the then President, Ferdinand E Marcos and wife Imelda Marcos, who was the Minister of Human Settlements and Community Development, to remove the slum dwellers from the streets and under bridges of Manila and relocate them to Cavite. Dr. Campos proposed to the government through the Secretary of Education, Juan L. Manuel, to offer a tertiary school in Dasmariñas, Cavite patterned after the Emilio Aguinaldo College that had been approved in Manila (Campos, 2008).

Consequently, a campus comprising 29 hectares was established. In 1976 to 1978, UPSI developed over a dozen school facilities including school rooms, laboratories, a library, social hall, an administration building, dormitories, an Olympic oval, a landscaped campus, and a man-made lake. They also built a network of roads that covered the whole campus and dormitories (Campos, 2008). A commitment to improve the lives of the underprivileged sectors of the community motivated EAC-Cavite to offer courses in Dressmaking, High Speed Machine Operation and Ceramics. All programs were structured either for six months or two years of intensive study and training.

In the following year, owing to the permit granted by Minister Juan Manuel of the Ministry of Education and Culture, EAC-Cavite opened the College of Criminology, listing among its students the police forces in Cavite as well as the members of the Philippine Constabulary and the security guards of the establishments in the vicinity. In addition, the Graduate Program leading to the degree of Master of Arts in Teaching was offered to provide the school teachers with professional and academic advancement and opportunities. Envisioned, too, were the programs for Master of Science in Nursing and Master of Arts in Education.

On October 21, 1979, General Emilio Aguinaldo Medical School Foundation Inc. (GEAMSF) was established in Dasmariñas, Cavite, thus giving birth to the Emilio Aguinaldo College- Cavite of Medicine with Dr. Lourdes E. Campos as Dean. In its first year of operations, the College had 150 students. The University Medical Center (UMC), which was built in 1980 and opened in 1983, served as the training center for the health science students of the College of Medicine and other health science courses.

In 1980, UPSI formed the Yaman Lahi Foundation, Inc. (YLFI) to manage and operate both Manila and Cavite campuses.

In 1986, when Dr. Paulo Campos was not in perfect health anymore, Brother Andrew Gonzales of the De La Salle University (DLSU) expressed the University's interest in acquiring the EAC College of Medicine and the University Medical Center (UMC). Since his UPSI colleagues were not ready to take over, Dr. Campos decided to transfer the ownership and responsibility to this worthy and credible institution.

It was in June 1987 when De La Salle University finally took over the management and the administration of two campuses from UPSI: the 29-hectare campus in Bagong Bayan, Dasmariñas and the 1.5 hectare Health Science Campus along Congressional Avenue. Included in the transfer were the two big buildings which had a length of 100 meters, 17-meter wide and seven levels of floor area with two elevators, including a basement, ground floor, and rooftop for water tanks and for viewing purposes. The 29-hectare property in Bagong Bayan had a dozen buildings that included classrooms, two administrative units, Olympic oval, network roads and a landscape that included a lake, teaching facilities, hospital equipment, a modest library and a historical museum. After that, the EAC Administration focused on the development of EAC-Manila.

EAC-Cavite reopened in 1996-1997 as a vocational technical school – Center for Technical Education and Skills Training (CTEST) - in a lot along Congressional Avenue (now Mangubat Avenue) which UPSI bought. In 1998, after the completion of five buildings, the voc-tech school became the EAC-Cavite campus and all academic courses were opened except medicine.

In 2001, under the leadership of Dr. Jose Paulo E. Campos, the first son of Dr. Jose Paulo E. Campos, the school administration strengthened the curricula of existing academic programs and opened new courses aligned with emerging trends. In 2003, the Commission on Higher Education (CHED) granted government recognition to AB Communication, Psychology, Business Administration, Accountancy, Computer Science, Secondary Education, and Hotel and Restaurant Management.

The other academic programs soon followed. In 2005, Elementary Education, Civil Engineering, Mechanical Engineering, and Diploma in Graduate Midwifery earned government recognition, followed by Nursing

and Criminology in 2006; Customs Administration in 2007; and Computer Engineering and Electronics and Communication Engineering in 2010.

In 2008, the Technical Education and Skills Development Authority (TESDA)-registered vocational-technical courses, namely, Automotive Servicing, Computer Hardware Servicing, Consumer Electronics Servicing, Machining, and Programming were offered. In response to the emerging trends on health sciences, real estate and tourism, the administration opened Medical Technology, Physical Therapy and Radiologic Technology in 2011, Doctor of Dental Medicine and Real Estate Management in 2012, and Bachelor of Science in Midwifery and Tourism Management in 2015.

In its quest to achieve excellent standards in higher education, the institution participated in the accreditation by the Philippine Association of Colleges and Universities Commission on Accreditation (PACUCOA), thus, receiving Level 1 Accredited Status in Nursing, Psychology, Criminology and Hotel and Restaurant Management programs in 2015 up to 2018. Likewise, Elementary Education, Secondary Education and Business Administration programs were granted Candidate Status until 2017.

Along with the commitment to innovate, the institution inaugurated the *Bulwagang Aguinaldo* in 2012, which was the replica of the Aguinaldo Shrine in Kawit, Cavite making it the ideal venue for the annual Philippine Independence Day Celebration held by the city government of Dasmariñas. The modernization of Buildings 3 and 4 which house the Life Science Institute, Engineering Science and Technology Institute, and School Library were completed in 2014. These developments sought to meet the needs of the growing student population.

In adhering to the call of the Department of Education (DepEd) headed by Secretary Bro. Armin Luistro to enhance the basic education program in the country, the institution earned the permit to implement the Senior High School programs in April 2015. This paved way for the restructuring of Building 5 for Senior High School and Building 6 which housed the new canteen and multi-purpose hall. The Senior High School started its operations and welcomed its pioneer batch in June 2016.

The institution strives to explore more avenues to serve its community and undertake worthwhile development programs towards its continuous transformation as a responsive and competent institution, as its Founders envisioned it to be.

*Special acknowledgements are accorded to Dr. Lourdes E. Campos (co-Founder), Atty. Paulo E. Campos Jr. (Director, EAEC), Dr. Jose Paulo E. Campos (EAC President), Dr. Georgina B. Palmario (Vice President for Academic Affairs), Ms. Maria Teresa Santos (Chief Librarian) and Ms. Shelley Anne C. Martinez (Executive Assistant) for their contributions to this manuscript.*

## **PHILOSOPHY**

Emilio Aguinaldo College is a private, non-sectarian, co-educational institution of learning that fosters equal and fair opportunities for the holistic development of the persons conscious of their national identity and their roles in the global community.

## **VISION**

Emilio Aguinaldo College envisions itself as an internationally recognized autonomous academic institution rooted in its nationalist tradition that consistently pursues the advancement and welfare of humanity.

## **MISSION**

Emilio Aguinaldo College provides an outcomes-based education with relevant curricula geared towards excellent research, active industry cooperation and sustainable community extension.

## **CORE VALUES**

### **Virtue**

Emilio Aguinaldo College integrates knowledge and understanding among Emilians equipping them with wisdom to choose to do only the right thing.

### **Excellence**

Emilio Aguinaldo College inculcates among Emilians the habit of doing only the best in all undertakings.

### **Service**

Emilio Aguinaldo College develops among Emilians a strong sense of duty and responsibility of helping others for the school, community, country and Mother Nature.



## **QUALITY POLICY**

We, the Employees and other stakeholders of Emilio Aguinaldo College are committed to:

Provide our students an exceptional educational experience delivered within all statutory and regulatory standards;

Provide consistent quality service to our students, parents, and other stakeholders;

Develop responsible students through relevant and quality education, able to independently lead and enhance their lives, and contribute to the development of our country and humanity; and

Continuously improve the educational experience of our students and other stakeholders by communicating the needs of our students and stakeholders to the entire organization, standardizing our institution's processes, enhancing our employees' competence, periodically reviewing and continually improving the institution's systems, and providing our students an exceptional educational experience.

## **QUALITY OBJECTIVES**

The objectives of Emilio Aguinaldo College are to:

- Offer opportunities for quality and relevant education to all qualified students;
- Cultivate the intellectual, spiritual, moral, social, and physical aspects of our students;
- Instill an appreciation and pride in our students of their national identity; and
- Prepare graduates of global quality equipped with world class competencies in their fields of expertise.

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# **Blood Glucose Lowering Activity of Sweet Basil (*Ocimum Basilicum* Linn.) Leaves Extract on Alloxan-Induced Sprague-Dawley Rats**

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## **KEYWORDS:**

- ***Ocimum basilicum***
- **Acarbose**
- **Sprague-Dawley Rats**
- **Oral Glucose Tolerance Test**
- **Alloxan Monohydrate**
- **Alloxan-Induced**

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**Abstract.** This study aims to determine the blood glucose-lowering activity of sweet basil (*Ocimum basilicum*) leaves extract in alloxan-induced diabetic rats. The blood glucose lowering activity of Sweet Basil leaf extract was determined through in-vivo analysis of 15 young male Alloxan-induced diabetic Sprague Dawley rats. An oral Glucose Tolerance Test (OGTT) was used to interpret the result. The study was conducted at Esteleydes

Animal Laboratory and Research Facility, which started in January 2023 and was completed by the second week of

July 2023. The phytochemical screening of the extract revealed the presence of tannins, saponins, alkaloids, glycosides, flavonoids, steroids, and triterpenoids, which may be accountable for the blood glucose-lowering activity of sweet basil (*Ocimum basilicum* Linn.). It has been demonstrated that administering sweet basil leaf extract to diabetic rats induced with alloxan lowers blood glucose levels in all basil leaf extract groups. At a dose of 400 mg/kgBW, the efficacy of sweet basil leaf extract was demonstrated. Acarbose 50 mg vs. Sweet Basil leaf extract 400 mg has no significant difference, stating that the 400mg of Sweet Basil Leaf Extract has the same efficacy as Acarbose 50 mg. Sweet basil leaf extract was proven to have blood glucose-lowering activity in alloxan-induced diabetic Sprague-Dawley rats.

## **Blood Glucose Lowering Activity of Sweet Basil (*Ocimum Basilicum* Linn.) Leaves Extract on Alloxan-Induced Sprague-Dawley Rats**

### **INTRODUCTION**

Insulin resistance and insulin deficiency are the defining characteristics of a variety of disorders that comprise type 2 diabetes, which has become a global pandemic. According to J Epidemiology Global Health, by 2020, 462 million people, or 6.28% of the world's population, will have type 2 diabetes. In 2017, it killed more than 1 million individuals. By 2030, the global prevalence of type 2 diabetes in all regions will be 7,079 cases per 100,000 people. Moreover, the Philippine Statistics Authority in 2021 stated that diabetes caused 1.5 million fatalities in 2019, with 48% of all diabetes-related deaths happening before the age of 70. This kind of diabetes, which until recently was solely present in adults, is now occurring in children. One of the most prevalent metabolic illnesses is diabetes mellitus. It is primarily distinguished by a lack of glucose homeostasis brought on by a disruption in the metabolism of carbohydrates, fats, and proteins as well as problems in insulin secretion or action, or both. A lack of insulin can prevent some body parts from properly utilizing the glucose present in the bloodstream. Hyperglycemia, or elevated blood glucose levels, are the result of this. Hepatic glucose production is directly related to hyperglycemia. Due to the resultant malfunction of  $\beta$ -cells, the production and release of insulin are reduced, leading to persistent hyperglycemia. Chronic hyperglycemia is closely linked to various microvascular complications of diabetes mellitus, including retinopathy, nephropathy, and neuropathy, particularly concerning the vascular endothelium.

Diabetes requires glycemic control in order to prevent any complications that might develop. According to Ezenyi, 2017, studies have conclusively shown that lowering blood glucose

slows the development and progression of microvascular problems.

Basil (*Ocimum basilicum* L.) is widely recognized both for its medicinal properties and as a culinary herb, thanks to its rich phytochemical composition. The crude extracts from basil leaves have generated considerable interest for their potential health benefits, notably in reducing blood glucose levels. According to Rumengan, et.al., 2019, a potential antihyperglycemic property of *O. basilicum*. Numerous research has mentioned basilicum. *O. Basilicum* is a popular herb that has both decorative and medicinal uses. The chemical elements that have been identified from the plant include terpenoids, alkaloids, flavonoids, tannins, saponin glycosides, and ascorbic acid. These substances have been linked to lower blood sugar levels. The flavonoid compounds and polyphenols, which are active substances that have pharmacological effects, are vulnerable to oxidation because they are unstable against the effects of temperature and high light levels.

In this study, the researchers determined the blood glucose lowering activity of sweet basil (*Ocimum basilicum*) leaves extract on alloxan induced diabetic rats with certain modifications to better understand the mechanism by which the leaves extract of sweet basil caused the significant decrease in the blood glucose level of the test animals.

## METHODOLOGY

The researchers utilized an experimental research approach, manipulating one variable to observe its impact on another. They applied controlled research methods and randomly assigned study participants to test their hypotheses. This method successfully established the relationship between two variables, specifically examining the effectiveness of sweet basil (*Ocimum basilicum*) crude extract and Acarbose in reducing blood glucose levels in rats with Alloxan-induced type II diabetes. (Cherry, 2022). The study provided a reasonable conclusion and yielded specific results, confirming the hypothesis regarding the effects of these substances on blood glucose in diabetic rats.

The fresh leaves of sweet basil (*Ocimum Basilicum*) were obtained from Villasias Fresh Herbs, Pangasinan, and identified at the Institute of Biology, College of Science, University of the Philippines, Diliman. The leaves were weighed and washed



before air-drying, then ground into a fine powder before extraction.

The collected 430g of powdered sweet basil leaves (*Ocimum Basilicum*) was weighed in a container and macerated using 95% ethyl alcohol for 48 hours with occasional stirring. The mixture was filtered and evaporated to dryness in a water bath until the concentrated extract was collected, weighed, and computed the percentage yield. The extract was transferred to a glass bottle and stored in the refrigerator for further use.

The in vivo analysis was conducted at Esteleydes Animal Laboratory and Research Facility owned by the IACUC Chairman, Dr. Leonardo I. Esteleydes DVM. Also, who was also the veterinarian in charge of supervising the study until it was finished, and under his guidance, the research protocols were followed.

Acarbose 50 mg was utilized as the positive control. It was dissolved in distilled water at a 0.5 mg/ml concentration and administered orally in diabetic rats for one day at different intervals. On the other hand, distilled water was utilized as the negative control.

The veterinarian conducted the induction of Diabetes via intraperitoneal injection of alloxan monohydrate 150 mg/kg. After two days, the glucose levels of Sprague Dawley Rats were checked using the OGTT, and blood glucose levels of more than 126 mg/dL were considered diabetic. The rats were sugar-overloaded one hour before the treatment.

Fifteen (15) Sprague Dawley rats are grouped into three groups. Two groups are treated with Acarbose, and the other is with *Ocimum basilicum* (Sweet basil) crude extract. The acclimatization of the rats was accomplished with the guidance of the animal facility. Before conducting the experimental procedures and treatment, the Sprague-Dawley rats were acclimatized for seven days to adjust to their new environment. The researchers adhered to the standard protocol, which included keeping the cage in an air-conditioned setting with a temperature of 24 + 2 degrees Celsius and relative humidity between 45 and 55%. For illumination, a 12- hour light-dark cycle was utilized. The animal diet consisted of standard rat pellets and potable drinking water. The rats were given food and water ad libitum. The research strictly follows and corresponds to the principle of the Institutional Animal Care and Use Committee (IACUC) recommendations that were strictly followed for animal care.

All groups were sugar-overloaded before the treatments, and the feeding schedule was stopped but continually given with

water as necessary. The Oral Glucose Tolerance Test (OGTT) determined the fasting blood sugar level. A drop of blood is placed in a calibrated glucometer to be used for data collection. It was done by pricking the lateral tail vein of the rat using a lancet every 0, 60, 120, 180, and 240 minutes after administering the treatments. The Acarbose was given at a dose of 50 mg/kg weight of rat, the *Ocimum basilicum* (Sweet basil) crude extract was given at a dose of 400 mg/kg weight of rat, and the distilled water, which is the negative control were provided 5 mL/kg weight of rat using the oral gavage with the maximum allowable volume of 10 mL/kg. Five blood collections were done within the whole-time frame of the experimentation. During the blood collection and the treatment, the rats were restrained using the standard tail and neck finger restraining.

One-Way Repeated-Measures Analysis of Variance (ANOVA) was conducted to determine the significant difference in the blood glucose-lowering activity within each treatment group. Post Hoc Tukey-HSD (Beta) was performed for the pairwise comparison Between the blood glucose-lowering activity within each treatment group of Acarbose (positive control), sweet basil leaves extract, and distilled water (negative control) across the different time intervals of administration.

### ***Ethical Considerations***

The adherence to ethical guidelines and the preservation of biological diversity is ensured through this approach. The researchers considered reducing the number of rats as much as possible and including only the number of rats required to maintain the scientific quality of this study. The researchers also ensure transparency in the research findings and facilitate sharing of data and material from this experiment. Furthermore, all drugs and extracts administered to the rats and blood extraction from the rats were handled by a veterinarian with sufficient knowledge and documented expertise in animal care.

## RESULTS

Table 1  
Percentage Yield of Collected Sweet Basil Leaves Extract

<b>Weight of Fresh Sweet Basil Leaves</b>	20,000g
<b>Weight of Sweet Basil Leaves extract</b>	21.43g
<b>Percentage yield</b>	0.107%

The percentage yield of collected sweet basil leaf extract is shown in Table 1. The Sweet basil leaves consisted of 20,000g fresh sweet basil leaves as an actual yield, 21.43g basil leaves extract theoretical yield, and a total of 0.107 % percentage yield.

Table 2  
Results of Organoleptic Evaluation on the Collected *Ocimum Basilicum* (Sweet Basil) leaves extract

<b>PHYSICAL TEST PARAMETERS</b>	<b>SWEET BASIL LEAVES EXTRACT</b>
<b>Color</b>	Dark Green
<b>Odor</b>	Strong Grassy Herbal Smell
<b>Appearance</b>	Thick dark green with a syrup consistency
<b>Taste</b>	Bittersweet
<b>pH</b>	7

The results of the organoleptic evaluation of the collected sweet basil (*Ocimum basilicum* Linn.) leaves are presented in Table 2. The collected leaves extract was observed to be dark green in color with a thick syrupy consistency, a strong, grassy herbal odor, and a bitter-sweet taste. The pH is 7, indicating that the crude extract has neutral pH.

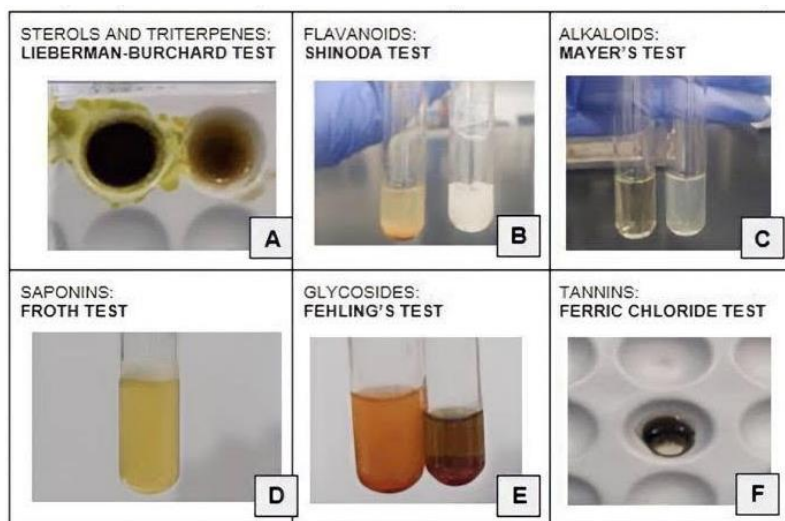
Table 3  
Results of the Solubility Behavior of the Collected *Ocimum Basilicum* (Sweet Basil) leaves extract

SOLVENT	SWEET BASIL LEAVES EXTRACT	
	Trial 1	Trial 2
<b>Polar Solvents</b>		
<b>Distilled Water</b>	Practically Insoluble	Practically Insoluble
<b>Methanol</b>	Slightly Soluble	Slightly Soluble
<b>NSS</b>	Practically Insoluble	Practically Insoluble
<b>Non-Polar Solvents</b>		
Table 3 (continued)		
<b>Methylene Chloride</b>	Very Soluble	Very Soluble
<b>Xylene</b>	Very Soluble	Very Soluble
<b>Hexane</b>	Very Soluble	Very Soluble

As shown in Table 3, the sweet basil (*Ocimum basilicum* Linn.) was very soluble in non-polar solvents (Methylene Chloride, Xylene, and Hexane). On the other hand, the crude extract was practically insoluble in polar solvents (Distilled water and NSS) and slightly soluble in methanol.

**Table 4**  
Results of Phytochemical Screening Performed on the Collected *Ocimum Basilicum* (Sweet Basil) leaves extract.

Phytochemical Constituents	Name of Test Performed	Expected Results	Leaves	
			Visible Results	Interpretation
Sterols	Lieberman-Burchard Test	Reddish brown coloration in the interface	Reddish brown coloration in the interface	(+) Positive
Triterpenes		Greenish color that turns blue on standing	Greenish color that turns blue on standing	(+) Positive
Flavonoids	Shinoda Test	Intense yellow coloration	Yellow coloration	(+) Positive
Alkaloids	Mayer's Test	Yellowish or white precipitate	White precipitate	(+) Positive
Saponins	Froth Test	Froth in 10 minutes	Froth in 10 mins	(+) Positive
Glycosides	Fehling's Test	Reddish-brown precipitate	Reddish-brown precipitate	(+) Positive
Tannins	Gelatin Test	White precipitate	White precipitate	(+) Positive



**Legend:**

A. Liebermann-Burchard Test

B. Shinoda Test

C. Mayer's Test

D. Froth Test

E. Fehling's Test

F. Ferric Chloride Test

*Figure 1. Ocimum basilicum Extract Phytochemical Screening Results*

Table 4 shows the specific phytochemical constituents present in Sweet Basil Leaves extract, including the test conducted and the visible results after the test, which will specify if certain phytochemicals are present. These phytochemical constituents are all responsible for blood glucose-lowering activity in Alloxan-induced Sprague Dawley rats. This means that chances are high that Sweet Basil leaves have antidiabetic activity.

Results obtained supports the study conducted by Tandi et al., 2021 that Basil leaf extract may reduce blood sugar and manage diabetes because of its hypoglycemic impact the presence of saponins, alkaloids, glycosides, tannins, flavonoids, steroids, and triterpenoids has been observed.

**Table 5**  
**Results of Blood Glucose Level After Administration of Alloxan Solution**

<b>Rat No.</b>	<b>Baseline Fasting Blood Sugar</b>	<b>Weight</b>	<b>After 2 days of Alloxan-Induction</b>	<b>Weight</b>
1	65 mg/dL	108 g	180 mg/dL	110 g
2	68 mg/dL	100 g	134 mg/dL	102 g
3	96 mg/dL	122 g	535 mg/dL	118 g
4	62 mg/dL	124 g	HIGH (600 mg/dL or higher)	116 g
5	92 mg/dL	100 g	376 mg/dL	94 g
6	92 mg/dL	114 g	566 mg/dL	108 g
7	68 mg/dL	96 g	496 mg/dL	84 g
8	90 mg/dL	120 g	137 mg/dL	120 g
9	79 mg/dL	114 g	345 mg/dL	114 g
10	76 mg/dL	96 g	138 mg/dL	90 g
11	60mg/dL	102 g	546 mg/dL	98 g
12	69 mg/dL	108 g	438 mg/dL	110 g
13	82 mg/dL	118 g	433 mg/dL	116 g
14	75 mg/dL	122 g	157 mg/dL	120 g
15	91 mg/dL	118 g	134 mg/dL	122 g

To increase the blood glucose level of the test animals, alloxan solution was administered via intraperitoneal injection to the Sprague-Dawley rats two days prior to the treatment. As shown in table 5, the baseline fasting blood sugar including the initial weight of the test animals were recorded, then after 2 days, it was observed that there was significant increase in blood glucose to peak levels in all the rats, to make sure that the rats were sugar-overloaded one hour before the treatment. Data presented revealed that all the representative fifteen (15) Sprague-Dawley rats produced significant increase in the blood glucose level with considerable increase in their body weights. The same data showing increased blood glucose level were used

to determine whether administration of the sweet basil leaves extract would cause the anticipated lowering activity. Thus, all the alloxan treated Sprague-Dawley rats are considered diabetic control group, and treatment was promptly initiated right after the identification of diabetes in the rats.

The induction of diabetes to test animals was adopted from the study of Rumengan et al 2019, diabetes mellitus was induced in fasted rats by a single intraperitoneal injection of freshly prepared Alloxan monohydrate dissolved in sterile normal saline, administered at a dose of 150 mg/kg body weight. After three days, measurements of fasting blood glucose levels confirmed the presence of diabetes mellitus. Rats with fasting blood glucose levels exceeding 126 mg/dL were categorized as diabetic and used in the subsequent experiments. Following the diagnosis of diabetes in rats, treatment was started right away. After receiving treatment, fasting blood sugar levels were checked every hour. All blood samples were taken at regular intervals from the rats' tail arteries.

**Table 6**  
Results of blood glucose lowering activity of the Treatment Groups on Alloxan-induced diabetic Sprague-Dawley rats

<b>Rat No.</b>	<b>Weight</b>	<b>Blood Glucose Level After Alloxan-Induction</b>	<b>Weight</b>	<b>Blood Glucose Level After 4 hours of Administration</b>	<b>Decrease in Blood glucose level</b>
<b>Positive Control (Acarbose 50mg)</b>					
1	110 g	180 mg/dL	108 g	124 mg/dL	56 mg/dL
2	102 g	134 mg/dL	104 g	121 mg/dL	13 mg/dL
3	118 g	535 mg/dL	124 g	100 mg/dL	435 mg/dL
4	116 g	HIGH (600 mg/dL or higher)	98 g	288 mg/dL	312 mg/dL
5	94 g	376 mg/dL	100 g	127 mg/dL	249 mg/dL



Table 6 (Continued)

<b>Experimental Control (Sweet Basil Leaves extract 400mg)</b>					
6	108 g	566 mg/dL	110 g	323 mg/dL	243 mg/dL
7	84 g	496 mg/dL	80 g	255 mg/dL	241 mg/dL
8	120 g	137 mg/dL	116 g	107 mg/dL	30 mg/dL
9	114 g	345 mg/dL	98 g	137 mg/dL	208 mg/dL
10	90 g	138 mg/dL	90 g	123 mg/dL	15 mg/dL
<b>Negative Control (Distilled water)</b>					
11	98 g	546 mg/dL	98 g	556 mg/dL	(+) 10mg/dL
12	110 g	438 mg/dL	106 g	485 mg/dL	(+) 47mg/dL
13	116 g	433 mg/dL	118 g	468mg/dL	(+) 35mg/dL
14	120 g	157 mg/dL	118 g	199 mg/dL	(+) 42mg/dL
15	122 g	134 mg/dL	118 g	141 mg/dL	(+) 7mg/dL

Results of blood glucose lowering activity of the treatment groups on Alloxan induced diabetic Sprague-Dawley rats showed that the administration of acarbose 50mg, sweet basil extract 400mg, and distilled water treated groups displayed considerable change in the blood glucose levels after 4 hours of treatment.

The treated groups with acarbose 50mg exhibited significant decrease in the blood glucose levels ranging from 13mg/dL to as high as 435mg/dL in rats' number 1 to 5, while those treated with sweet basil leaves extract 400mg showed substantial decrease of 15mg/dL to 243mg/dL in rats' number 6 to 10 based on the decrease in their blood glucose level after Alloxan-induction. This may infer that the sweet basil treated group showed comparable blood glucose lowering activity with the acarbose 50mg treated group. Data demonstrated that both the acarbose 50mg and sweet basil leaves extract 400mg treated groups confirmed their blood glucose lowering activities after the treatment. The observed decrease in blood glucose levels at this dosage suggests that it may be attributed to the inhibition of carbohydrate metabolizing enzymes, which restricts glucose absorption, as well as the promotion of hepatic glucose

mobilization. The supporting research by Lazzaroni E. et al., 2022, suggests that acarbose, the compound under consideration is a multifaceted oligosaccharide that functions as a competitive and reversible inhibitor of pancreatic alpha-amylase as well as membrane-bound intestinal alpha-glucoside hydrolase. It facilitates the hydrolysis of complex carbohydrates into oligosaccharides within the small intestine. Additionally, the intestinal alpha-glucosidase hydrolase is responsible for the conversion of oligosaccharides, trisaccharides, and disaccharides (such as sucrose and maltose) into monosaccharides (specifically glucose and fructose) within the brush border of the small intestine. Acarbose retards the process of carbohydrate digestion, hence decelerating the absorption of glucose., decreasing postprandial glucose blood concentrations. On the other hand, the study's findings supporting the blood sugar-lowering properties of sweet basil leaves supported the theory by Widjaja et al. in 2019 that sweet basil leaves are frequently used to lower blood sugar in diabetic patients. Basil leaves are said to promote insulin release from the pancreas, the inhibition of hepatic glucose production and the promotion of glycogen synthesis, all of which have been linked to antihyperglycemic and liver-protective characteristics. Eziana et al., 2017 also discovered that the extract prevented maltose from being produced by  $\alpha$ -amylase. Aspartate aminotransferase and alanine aminotransferase levels were also lowered in the diabetes treatment groups by the sweet basil extract.

Finally, the negative control (distilled water) treated group showed contradictory results with the positive control and experimental control showing decreased blood glucose levels, since the test animals represented by rats' number 11 to 15 were already observed to have increased blood glucose levels without any intervention, the test animals were all detected to have developed hyperglycemia over-time as shown by the heightened blood glucose levels.

**Table 7**

Summary of ANOVA F-test for the significant difference in the blood glucose-lowering activity within each treatment group of acarbose (Positive control), sweet basil leaves extract, and distilled water (Negative control) across the different time intervals of administration

Source	SS	df	MS	F-ratio	p-value	Interpretation / Decision
Between treatments	164316.13	2	82158.067	F= 6.18021	p-value is .014288	Significant at $p < .05$
Within treatments	159524.8	12	13293.73			Reject $H_0$
Total	323840.93	14				

Results of ANOVA F-test in table 7 showed that significant differences existed between the blood glucose-lowering activity of the different treatment groups of acarbose (positive control), sweet basil leaves extract, and distilled water (negative control) across the different time intervals of administration as indicated by the computed F-value of 6.18021 with a p-value of .014288 being lower the .05 level of significance at 2 degrees of freedom between treatments, and 12 degrees of freedom within treatments, therefore, the hypothesis postulated in chapter 1 was hereby rejected. Data implied that although, the treatment groups of acarbose (positive control) and sweet basil leaves extract (experimental group) exhibit comparable blood glucose lowering activity, the treatment groups between acarbose and distilled water (negative control) as well as sweet basil leaves extract and the negative control significantly differ in terms of their blood glucose lowering activity, therefore, since not all these variables did not meet similar expected results, it instigated discrepancies in the overall blood glucose lowering of the concerned variables.

Table 8

Pairwise Comparison {(Post Hoc Tukey-HSD (Beta))} Between the blood glucose-lowering activity within each treatment group of acarbose (Positive control), sweet basil leaves extract, and distilled water (Negative control) across the different time intervals of administration.

Paired Variables	Weighted Mean		HSD <sup>.05</sup> = 194.5422	Q <sub>.05</sub> = 3.7729	p-value	Interpretation	Decision
positive control (Acarbose 50mg) vs Sweet basil leaves extract 400mg	152	189	37.00	0.72	.86918	Not Significant at p>.05	Acarbose 50mg has comparable blood glucose lowering with Sweet basil leaves extract 400mg
positive control (Acarbose 50mg) vs Negative control (distilled water)	152	390.20	238.20	4.62	.01718	Significant at p<.05	Acarbose 50mg has better blood glucose lowering
Sweet basil leaves extract 400mg vs Negative control (distilled water)	189	390.20	201.20	3.90	.04256	Significant at p<.05	Sweet basil leaves extract 400mg has better blood glucose lowering

Data on table 8 shows that the positive control acarbose 50mg, (M=152) exhibit better blood glucose lowering activity than the experimental control, sweet basil 400mg leaves extract (M=189) as indicated by the computed p-value of .89791, which is greater than .05 level of significance. Further analysis revealed that HSD.05 of 37 is lower than the true value of HSD.05 of 222.2988, while the Q.05 of 0.63 is even lower than the true Q.05 value of 3.7729, hence, no significant difference existed between these variables indicating that the 400mg sweet basil extract has comparable blood glucose lowering with that of acarbose 50mg.

Between the positive control (Acarbose 50mg) and the Negative control (distilled water), both the computed HSD.05 equivalent to 238.20 and Q.05 of 3.7729 are greater than their standard values of 4.62 194.5422, which gave a p-value of .01718 lower than .05 level of significance, thus, significant difference existed between these variables indicating that acarbose 50mg has exhibit blood glucose lowering, whereas, the negative control, distilled water, was observed to cause higher blood glucose level in the test animals.

Lastly, sweet basil leaves extract 400mg exhibit blood glucose lowering, as shown by the computed HSD.05 of 201.20, and a Q.05 of 3.90, which are both found greater than their standard values. Therefore, it may be implied by these findings that sweet basil leaves extract 400mg exhibit blood glucose lowering while the negative control, distilled water, was similarly observed to cause an even increase blood glucose level in the test animals.

Therefore, it may be concluded that the blood glucose-lowering effects of 400 mg of sweet basil leaf extract are equivalent to 50 mg of acarbose, the positive control.

## **DISCUSSION**

Sweet basil (*Ocimum basilicum* Linn.) leaves extract contains phytochemical constituents, including triterpenoids, steroids, alkaloids, glycosides, tannins, flavonoids, and saponins. The extracted plant produces a thick, sticky, dark green substance with a syrupy consistency and a strong, grassy, herbal odor. It also has a bittersweet taste and is insoluble in water.

It has been demonstrated that administering sweet basil leaf extract to diabetic rats induced with alloxan lowers blood glucose levels in all basil leaf extract groups. At a dose of 400 mg/kgBW, the efficacy of sweet basil leaf extract was demonstrated in Table 6. There is evidence that quercetin and basil leaf extract have antihyperglycemic properties. The specific flavonoid present in the plant has the highest levels that are accountable for the activity of reducing blood glucose levels to the study by Tandi J. (2021). The mechanism of action of Flavonoids in lowering blood glucose is by improving glucose tolerance by reducing the postprandial rise in blood sugar level, likely through enhanced insulin sensitivity or 48 increased glucose uptakes by skeletal muscle and adipose tissue Al-Ishaq, R (2019).

Acarbose 50 mg vs. Sweet Basil leaf extract 400 mg has no significant difference, stating that the 400mg of Sweet Basil Leaf Extract has the same efficacy as Acarbose 50 mg. The comparison of Acarbose 50 mg vs. the negative control group (Distilled water) showed a significant difference indicating the effectiveness of Acarbose in treating type 2 diabetes. While the comparison of Sweet Basil leaf extracts 400 mg vs. negative control group (Distilled water) showed a significant difference, indicating that sweet basil leaf extract exhibits blood glucose lowering activity in alloxan-induced diabetes Sprague-Dawley rats.

## **CONCLUSION**

The extract of sweet basil leaves (*Ocimum basilicum* Linn.) has a thick, dark green color, a syrupy consistency, and a solid grassy, herbal odor. It has a bittersweet taste and a neutral pH level (7). The Solubility Behavior of the Collected *Ocimum Basilicum* (Sweet Basil) Leaves Extract revealed that it is soluble in non-polar solvents (Methylene Chloride, Xylene, Heptane) but only slightly soluble in a polar solvent (Methanol). In addition, the phytochemical screening of 49 the extract revealed the presence of tannins, saponins, alkaloids, glycosides, flavonoids, steroids, and triterpenoids, which may be accountable for the blood glucose-lowering activity of sweet basil (*Ocimum basilicum* Linn.)

Sweet basil leaf extract was proven to have blood glucose-lowering activity in alloxan-induced diabetic Sprague-Dawley rats.

The blood glucose-lowering activity differed significantly within each treatment group of Acarbose (Positive control), sweet basil leaves extract, and distilled water (Negative control) across the different time intervals of administration.

### **Recommendations**

Based on the findings, the researchers would like to recommend the following:

1. Further studies on the specific secondary metabolites of the phytochemical constituents responsible for lowering blood glucose levels and the specific percentage of the constituents present in sweet basil (*Ocimum basilicum* Linn.) leaves.
2. Studies on the long-term effects and toxicities of sweet basil consumption. Furthermore, interactions with other synthetic drugs, herbal medications, or specific diseases should also be investigated.
3. Studies on the different concentrations and dosages of sweet basil (*Ocimum basilicum* Linn.) leaves extract.

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# COMPARATIVE EFFICACY OF GEL HAND SANITIZER FROM *Kappaphycus alvarezii* (SEAWEED) AND COMMERCIAL HAND SANITIZER AGAINST *Escherichia coli* AND *Staphylococcus aureus*

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## KEYWORDS:

- *Eucheuma cottonii*
- Inhibitory activity
- Minimum inhibitory concentration
- Dilution Method
- Agar-well Diffusion Method
- Spectrophotometry
- Zone of Inhibition

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**Abstract.** This study evaluated the efficacy of gel hand sanitizer derived from the seaweed *Kappaphycus alvarezii* compared to commercial hand sanitizer against *Escherichia coli* and *Staphylococcus aureus*. The research objectives were successfully achieved through a series of experiments. Firstly, various concentrations of *K. alvarezii* extract (2%, 4%, 6%, 8%) were tested using the liquid dilution technique to

determine the minimum inhibitory concentration. The 6% concentration demonstrated the most effective inhibitory activity against both bacterial strains. Spectrophotometric analysis confirmed the inhibitory activity of *K. alvarezii* extract. Subsequently, a seaweed gel hand sanitizer containing 6% *K. alvarezii* extract was formulated using mechanical dispersion, exhibiting favorable characteristics such as uniformity, light blue color with pleasant ocean breeze scent, and appropriate 6.1 pH level. An Agar well diffusion test compared the inhibitory activity of *K. alvarezii* gel hand sanitizer with commercial hand sanitizer. While both sanitizers showed efficacy against *E. coli*, the seaweed gel hand sanitizer exhibited a slightly larger inhibition zone (ZOI seaweed gel hand sanitizer = 16 mm and ZOI commercial hand sanitizer = 15 mm). In contrast to *S. aureus*, the commercial hand sanitizer exhibited a larger inhibition zone (ZOI commercial hand sanitizer = 16 mm; ZOI seaweed gel hand sanitizer = 12 mm). Statistical analysis revealed a significant difference in inhibitory activity between the two sanitizers. These findings suggest that *Kappaphycus alvarezii* gel hand sanitizer could be a viable alternative to commercial products, particularly against certain bacterial strains.

# COMPARATIVE EFFICACY OF GEL HAND SANITIZER FROM *Kappaphycus alvarezii* (SEAWEED) AND COMMERCIAL HAND SANITIZER AGAINST *Escherichia coli* AND *Staphylococcus aureus*

## INTRODUCTION

A call to arms has been initiated in response to global unease over infectious disease propagation—the unyielding demand for proper hand hygiene. Throughout time, hand washing with soap and water has been lauded by organizations like UNICEF as a cardinal principal measurement to prevent the spread of diseases such as diarrhea or acute respiratory infections (UNICEF, 2020). The value of hand hygiene was further underscored by the advent of the COVID-19 pandemic. During this time, the Centers for Disease Control and Prevention recommended that individuals play a significant role in virus prevention through proper hand washing, including using hand sanitizers (CDC, 2022).

In a global health perspective, the market for hand sanitizers has seen a significant rise, and this growth is now occurring even in developing countries like the Philippines, which are seeing economic expansion that runs parallel with awareness of hygiene practices, according to Statista Research and Development (2020). The increase offers the possibility to delve into creative formulations that satisfy regulations while also providing sustainable and efficient solutions.

The purpose of this research is to delve into this field and explore the possibilities of *Kappaphycus alvarezii*. This extract is obtained from a species of red seaweed, *Kappaphycus alvarezii*, that thrives abundantly in Philippine waters and could be used as

an active element in hand sanitizers. From earlier studies, different bioactive compounds have been found present within *Kappaphycus alvarezii* that demonstrate anti-pathogenic properties against pathogens (Ledesma, 2023). It suggests that this product has potential for application in sanitary materials; given these indications, it may play a key role.

This study aims to find out what the minimum inhibitory concentration (MIC) of *Kappaphycus alvarezii* extract is for *Escherichia coli* and *Staphylococcus aureus*. Additionally, to see how gel hand sanitizer made from seaweed extract looks and behaves, and lastly, to compare the effectiveness of it to commercially available hand sanitizer and how gel made from seaweed extract behaves and looks. The methodology is guided by the conceptual framework, which is based on the experimental design for the MIC measurement, comparative analysis, and evaluation of product attributes critical for customer acceptance and compliance with regulations.

Thus, the intent of this study is to contribute to public health and boost the economy through new product creation in the hygiene sector. By investigating the possibilities of integrating natural extracts such as *Kappaphycus alvarezii* into hand sanitizers, thereby filling existing knowledge gaps.

## METHODOLOGY

The primary objective of the study is to compare commercial hand sanitizers with a seaweed-based gel hand sanitizer in relation to their effectiveness against *Escherichia coli* and *Staphylococcus aureus* using an experimental design. The researchers made use of scientific methods to establish how these sanitizers are able to suppress the growth of bacteria by conducting a true experiment where bacterial cultures were established, treated with the sanitizers, and growth inhibition determined. Both t-tests were used as statistical measures to compare the inhibitory activities of both sanitizing agents. This

research was conducted at Emilio Aguinaldo College Cavite (EAC-C), making full use of its Biology, Chemistry, Pharmacy and Physics laboratories.

Stringent safety procedures, such as the utilization of Personal Protective Equipment (PPE) and working under sterile conditions in a laminar flow cabinet, were followed when handling potentially pathogenic bacteria during experimental processes. Consequently, the results of these processes help assess the possibilities of using *Kappaphycus alvarezii* extract in a seaweed-based gel sanitizer as an antibacterial agent.

According to the World Health Organization (n.d.), items such as laboratory cultures and stocks, agar plates, human and animal cell cultures, stocks of disease-causing agents, unused live and attenuated vaccines or serums, culture dishes, and other equipment used for handling, inoculating, or mixing cell cultures must be handled with personal protective equipment (PPE) to avoid exposure to aerosols. After use, it should be disposed of through on-site steam or chemical disinfection using an autoclave set to a minimum of 121 °C for at least 30 minutes.

### **Sample Collection**

Seaweed samples of *Kappaphycus alvarezii* were collected from Calatagan, Batangas. The collected samples were kept in an icebox with seawater to maintain their ideal environment. Then, the seaweeds were identified by the University of the Philippines Los Baños Museum of Natural History. The identified *Kappaphycus alvarezii* were screened for the evaluation of their inhibitory activity.

### **Acquisition of Test Bacteria**

The pathogenic bacteria *Escherichia coli* (*E. coli* S 120423) and *Staphylococcus aureus* (*S. aureus* S 082233) were obtained from the School of Medical Technology, Emilio Aguinaldo College Cavite. The bacteria were incubated (Incubator Model: Memmert IN55) at 37 °C for twenty-four hours. Then, a



needle loop containing one of the selected bacteria was placed on Nutrient Agar media (Paju et al., 2013, as cited in Akib et al., 2019).

### **Preparation of Nutrient Agar (NA) Media**

In 500 mL of distilled water, 7.12 grams of NA media were dissolved and boiled until dissolved. The media solution was poured into each petri dish containing at least 10 mL and autoclaved (Model: PTS-B50L Autoclave 50L) for 15 minutes at 121 °C and 15 psi (Akib et al., 2019).

### **Preparation of Nutrient Broth (NB) Media**

In 1000 mL of distilled water, 15 grams of NB media were dissolved and boiled until dissolved. The media solution was poured into each tube containing 5 mL and autoclaved for 15 minutes at 121 °C and 15 psi (Akib et al., 2019).

### **Preparation of Mueller Hinton Agar (MHA) Media**

In 500 milliliters of distilled water, 19 grams of the medium were dissolved. They were boiled for one minute, stirring often, to fully dissolve the medium. They were then autoclaved at 121 °C and 15 psi for 15 minutes. After cooling to room temperature, Mueller Hinton Agar (MHA) was poured onto sterile Petri plates that were horizontally flat while the MHA temperature was at 42 °C. At room temperature, the agar was allowed to become solid. Petri dishes were allowed to adjust to room temperature before inoculating them, ensuring the agar surface was dry (Aryal, 2022).

### **Preparation of Bacterial Suspension**

Three colonies of rejuvenating bacteria were placed into 10 mL of 0.9% NaCl, homogenized using a vortex (Model: Digisystem VM-2000) and compared to a McFarland standard of 0.5. The turbidity of the bacteria was calculated according to the McFarland standard of 0.5 (Akib et al., 2019). Seaweed Bioactive Compounds Extraction The seaweed extract in this study was

derived from the marine red algae *Kappaphycus alvarezii*. In order to reduce metabolite disintegration in samples that were unstable to heating, the extraction was performed using a maceration approach. Maceration is a traditional process for extracting compounds from seaweed biomass by immersing it in a suitable solvent (Cotas et al., 2020). A five-kilogram seaweed sample was rinsed with distilled water to remove extraneous matter, chopped into small pieces, dried with a drying oven at 40 °C for 24 hours, and powdered in a mixer grinder (Model: Hanabishi Super Blender HJB128SS). The 300g dry powder was macerated with 900 mL methanol solvent for 24 hours. The filtration process was carried out using filter paper (Whatman filter paper #1), and was repeated several times until the filtrate was clear. To achieve a thick extract, the residual solvent in the filtrate was evaporated using a rotary evaporator (Heidolph 036000050 Model Hei-Vap Value the Collegiate Rotary Evaporator) set to 60 °C at 80 rpm and a water bath (Digisystem Circulating water bath DSB-500 / DSB-1000) set to 60 °C (Akib et al., 2019; Andriani et al. 2016).

### **Preparation of Seaweed Extract Solution**

A 10 µL of seaweed extract was dissolved in 1 mL of Dimethyl sulfoxide (DMSO) and the resulting solution was diluted to produce concentrations of 2%, 4%, 6%, and 8% (Capillo et al., 2018). Various extract concentrations referred to the minimum inhibitory concentration of *Kappaphycus alvarezii*, which was 6% against *Escherichia coli* and *Staphylococcus aureus*, respectively (Andriani et al., 2016; Pushparaj et al., 2014 as cited in Rima et al., 2022). The positive control tube contained 2% tea tree oil in DMSO solvent (Hili et al., 1997, as cited in Leja et al., 2019). Determination of Minimum Inhibitory Concentration (MIC) The liquid dilution technique was used to determine inhibitory activity of *Kappaphycus alvarezii*. The goal of testing the extract's inhibitory activity was to determine the Minimum Inhibitory Concentration, which was utilized to determine the concentration of the extract in the hand sanitizer gel formulation. *Escherichia coli* and *Staphylococcus aureus* were utilized as test bacteria. The

average of duplicates was used to determine each experimental outcome.

Eight test tubes containing 5 mL of Nutrient Broth medium and 100  $\mu$ L of bacterial suspension were prepared. Test tubes labeled A, B, C, and D were added with 100  $\mu$ L of extract solution for each concentration variation (2%, 4%, 6%, 8%). The positive control tube (K1) was added with 100  $\mu$ L of 2% tea tree oil. The solvent control tube (K2) was added with 100  $\mu$ L of Dimethyl sulfoxide. The negative control tube (K3) was without any addition. The standard control tube (K4) solely contained NB media. All test tubes were incubated (Incubator Model: Memmert IN55) for 24 hours at 37 °C before measuring bacterial development in the form of turbidity using a Spectrophotometer (722N VIS Spectrophotometer). The MIC was the lowest extract concentration with a low absorbance value, indicating a low quantity of bacteria or none at all (Akib et al., 2019).

## Gel Preparations

The study employed the mechanical dispersion method to prepare hand sanitizer gel, which involved dissolving all components in the solvent and stirring until a homogenous gel mass was created (Akib et al., 2019; Sidauruk et al., 2021).

0.5 grams of Carbopol was placed in 50 mL of distilled water and left to stand for 24 hours at room temperature. Five drops of triethanolamine were added to produce mass A. 0.2 grams of Methylparaben and 1 mL of *Kappaphycus alvarezii* extract solution were dissolved in 15 mL propylene glycol to create mass B. Mass B was gradually added to mass A and mixed until homogeneous. The 13.3 mL of water was added to form Mass C. One drop of blue dye was dissolved in 15 mL ethanol, then added to mass C until homogeneous, followed by 2 drops ocean breeze aroma (Akib et al., 2019; Sidauruk et al., 2021).

## Comparison Between the Inhibitory Activity of Seaweed Gel Hand Sanitizer and Commercial Hand Sanitizer

The agar well diffusion technique was performed, evaluated and was used to compared the inhibitory activity of a seaweed-based gel hand sanitizer against *Escherichia coli* and *Staphylococcus aureus*. A needle loop of *E. coli* and *S. aureus* was transferred to each respective sterile Petri dish with Muller Hinton Agar (MHA) medium and distributed with a sterile spreader to form a lawn. A sterile cork borer was used to create four wells of 9 mm diameter in each MH agar plate. With sterile micropipettes, 100 µL of seaweedbased hand sanitizer and commercial hand sanitizer were applied to each well of their respective inoculated MH agar plates. All prepared Petri dishes were incubated at 37 °C for 18 to 24 hours. The diameter of the inhibitory zones in each well was measured in millimeters to determine inhibitory activity. Each trial was conducted in duplicate, and the average was used to determine the outcome of each experiment (Pushparaj et al., 2014, as cited in Rima et al., 2022).

### Gel Hand Sanitizer Characterization

#### a. Organoleptic Testing

The organoleptic test, often known as sensory testing, relies on the human senses to determine product approval. Organoleptic testing serves an essential function in quality assessment. The gel formulation was tested physically; including odor, color, and consistency. The evaluation was carried out on gel hand sanitizer maintained at room temperatures (Ansel, 1989, as cited in Akib et al., 2019).

#### b. pH Test

The pH test was performed using a pH meter (Model: Multifunctional tester 9909SP) and pH test strips Litmus paper (DF Universal Test Paper) dipped in 1 gram of gel liquefied in 10 ml of distilled water for half a second. This was compared with the standard hand sanitizer color (Setyoningrum, 2010 as cited in Akib et al., 2019).

### c. Evaporation Rate

Researchers also measured the evaporation rate. The evaporation rate of hand sanitizer was investigated in Petri dishes. Three grams of gel hand sanitizer were placed in Petri dish to determine the evaporation rates. The Petri dish was covered, then placed on a stirring hot plate (Model: Corning® PC-420D stirring hot plate) set to 34 °C to imitate the hand temperature. The cover was removed to measure the mass of the gel hand sanitizer every 30 seconds for up to 3 minutes using the Triple beam balance (Model: Ohaus Triple Beam Balance - 700 series). The evaporation was calculated by deducting the mass measured every 30 seconds from the initial mass at time zero. These measurements were

## Data Analysis

The researchers used spectrophotometric (turbidimetric) analysis, one-way ANOVA, and T-test to evaluate three different data.

### Statistical Treatments

Objective 1: To determine the minimum inhibitory concentration of *Kappaphycus alvarezii* extract using the following concentration against *Escherichia coli* and *Staphylococcus aureus*.

a. 2% b. 4% c. 6% d. 8%

One-way ANOVA The one-way analysis of variance (ANOVA) compared the averages of three or more groups using a single independent and dependent variable. Additionally, it is a simple and effective test that could detect even minor variations across means (Bevans, 2020). The researchers used one-way ANOVA to calculate the mean of each concentration of 2%, 4%, 6%, and 8% in relation to the growth of bacterial strains to identify

the significant difference in inhibitory activity of the *Kappaphycus alvarezii*. It was accomplished by first calculating the mean value and sum of squares of the seaweed concentrations. The F statistic was then computed using the sums of squares. The F-statistic was used to determine whether or not the distinction between the mean of each group was significantly different. The one- way ANOVA findings demonstrated if the highest concentration value had a difference in inhibitory activity among the five groups.

Objective 2: To compare the inhibitory activity of *Kappaphycus alvarezii* gel hand and a commercially available hand sanitizer against *Escherichia coli* and *Staphylococcus aureus*.

T-test A t-test was used for determining if there is a significant difference in the means of two sets of data or groups in order to determine how they are related to one another. The null hypothesis for the t-test stated that two groups are equal and do not differ significantly from one another. This process was performed by calculating the standard deviation, the variance of each mean, and the number of data values of each group. The output of the ttest had to produce two values: t-value which could be acquired from the table of two-tailed test and degrees of freedom (Hayes, 2022). The researchers used a T-test to investigate the inhibitory activity of two groups: gel hand sanitizer with a seaweed extract and commercial hand sanitizer, both of which were tested on *Staphylococcus aureus* and *Escherichia coli*. The results of the t-test were expressed as a p-value. The P-value, also known as the probability value, was primarily used in hypothesis testing to evaluate if the study would reject the null hypothesis. The lower the p-value, the more likely the study would reject the null hypothesis (Bevans, 2020).

Objective 3: To assess the following aspects of the seaweed gel hand sanitizer

a. Organoleptic characteristics (odor, color, consistency)

The organoleptic test, commonly referred to as sensory testing, relied on human senses to evaluate product acceptance. The gel formulation underwent physical testing, including assessments of odor, color, and consistency.

b. pH level

The pH level was determined based on average data recorded using a pH meter (Model: Multifunctional tester 9909SP) and Litmus paper pH test strips (DF Universal Test Paper).

c. Evaporation rate

The evaporation rate was determined based on average recorded data calculated from the measured mass every 30 seconds, starting from the initial mass at time zero and ending with the final mass at 180 seconds.

### ***Ethical Consideration***

This study protocol has been reviewed by the Emilio Aguinaldo College-Cavite Ethics Review Committee with EACC ERC Code 2024-03-027 and was exempted from further review as it does not involve human subjects, respondents, or participants.

## **RESULTS**

The findings presented in this section was align with research objectives and have been meticulously examined using appropriate statistical approaches. This section provides an overview of the results obtained from investigation about seaweed extract concentration and its application in hand sanitizers, including a full analysis of the significant findings and implications found in the data collected.

### Minimum Inhibitory Concentration (MIC) of *Kappaphycus alvarezii* extract solution

Table 1

*Absorbance and Transmission Value of Kappaphycus alvarezii extract solution against E. coli and S. aureus*

	2%	4%	6%	8%	K1 Positive Control	K2 Solvent Control	K3 Negative Control	K4 Standard Control
Absorbance Value	0.042	0.041	0.026	0.033	0.042	0.032	0.041	0.021
Transmission Value	90.83%	91.63%	94.33%	93.43%	93.10%	93.15%	90.90%	95.30%

**Note.** The lower the absorbance value, the greater the transmission value, indicating lower bacterial growth. The four concentrations (2%, 4%, 6%, 8%) represented the concentration levels of *K. alvarezii* extract. K1 consisted of Nutrient broth with bacterial suspension and 2% tea tree oil. K2 comprised of Nutrient broth with bacterial suspension and DMSO. K3 included Nutrient broth with bacterial suspension, while K4 contained Nutrient broth only.

In relation to the results obtained from the spectrophotometric analysis of minimum inhibitory concentration of *Kappaphycus alvarezii* extract solution; among the four concentrations (2%, 4%, 6%, 8%) of *K. alvarezii* extract solution, the 6% concentration had the lowest absorbance value of 0.026, followed by 8% with a value of 0.033. These values were lower than those of the negative control (K3), which contained nutrient broth and bacteria, as well as lower than the solvent control (K2), consisting of nutrient broth, bacteria, and the solvent DMSO. Both control samples lacked active ingredients from the *K. alvarezii* extract. These indicate that the *K. alvarezii* extract demonstrated inhibitory activity against the two tested bacteria, *E. coli* and *S. aureus*. The 6% concentration closely resembled the standard control (K4), which only contained nutrient broth, and had a value of 0.021.



## Inhibitory Activity of Seaweed Gel Hand Sanitizer and Commercial Hand Sanitizer

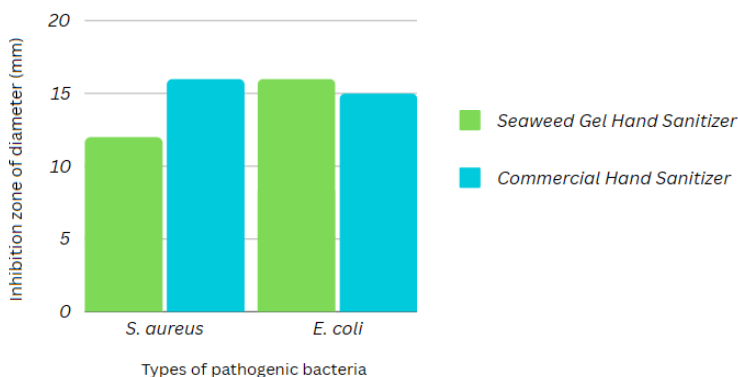


Figure 1. Zone of inhibition (mm) formed by Seaweed gel hand sanitizer and Commercial sanitizer against the test bacteria

Figure 1 showed that the seaweed gel hand sanitizer containing 6% *K. alvarezii* extract had inhibitory activity on both *E. coli* and *S. aureus* bacteria which is characterized by the formation of inhibition zone 16 mm and 12 mm, respectively. The inhibition zone formed was presumably because the seaweed contained bioactive compounds as antibacterial, thus inhibiting the growth of the bacteria (SW Sidauruk et al., 2021). In contrast, Commercial hand sanitizer had a 16 mm zone of inhibition against *S. aureus* and 15 mm on *E. coli*.

*COMPARATIVE EFFICACY OF GEL HAND SANITIZER FROM *Kappaphycus alvarezii* (SEAWEED) AND COMMERCIAL HAND SANITIZER AGAINST *Escherichia coli* AND *Staphylococcus aureus**

Table 2

*T-test for Equal Variance: Seaweed Gel Hand Sanitizer and Commercial Hand Sanitizer*

t-Test: Two-Sample Assuming Equal Variances	Seaweed Gel Hand Sanitizer	Commercial Hand Sanitizer
Mean	14	15
Variance	8	0.5
df	2	
t Stat	-0.727606875	
P(T<=t) two-tail	0.542504289	
t Critical two-tail	4.30265273	

**Note:** The two hand sanitizers had a t-value of - 0.727, a p-value of 0.542, and 4.302 t-critical or significance value based on the degree of freedom of two.

Table 2 showed the T-test results of seaweed gel hand sanitizer and commercial hand sanitizer with a mean score of 14 and 15.5, respectively. The p-value is lower than the significance level (4.302) when compared to the 0.05 threshold of significance. This suggests that the obtained data have established a statistically significant difference between the inhibitory activity of the two types of hand sanitizers.

## Seaweed Gel Hand Sanitizer Characterization

### a. Organoleptic Characteristics

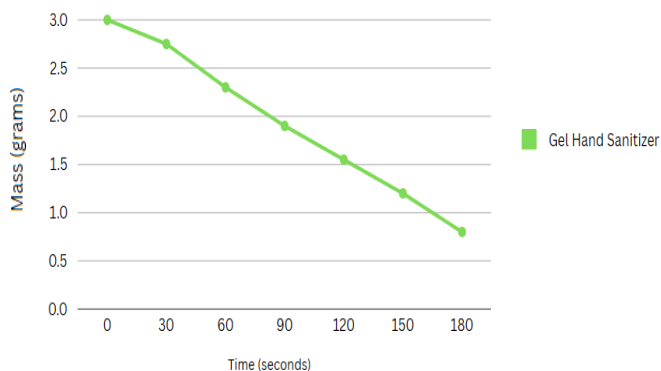
The gel displayed uniformity, featuring a distinct ocean breeze scent without any unpleasant seaweed odor, accompanied by a light blue hue. No separation of phases was observed, and the gels were easily applicable, spreading smoothly with a consistent texture. Bergounhe (2021) highlighted that thin gels are easy to handle but prone to dripping, which can lead to messiness and product waste. Conversely, thick gels may excessively delay evaporation, leaving users with prolonged slimy hands or causing packaging issues.

## b. pH Test

The pH values of the formulated hand sanitizer gels were determined through the utilization of both a digital pH meter and pH test strips. Through these methods, the pH level of the gel hand sanitizer was determined to be 6.1. Booq et al. (2021) recommended that maintaining the pH level of topical formulations within the skin's wide pH range, typically spanning from 4.0 to 7.0, can help reduce the likelihood of skin inflammation and irritation.

## c. Evaporation Rate

Figure 2. Gel Hand Sanitizer Evaporation Time (3 g of gel for 3 minutes)



*Note:* At 0 seconds, the initial mass was 3 grams, which decreased to 2.75 grams after 30 seconds. Subsequently, it decreased further to 2.3 grams, then to 1.9 grams, followed by 1.55 grams, then 1.2 grams, and finally to 0.8 grams after 180 seconds.

The investigation involved determining and computing the evaporation rate of hand sanitizer. This was achieved by subtracting the mass measured every 30 seconds from the initial mass recorded at time zero. Starting with an initial mass of 3

*COMPARATIVE EFFICACY OF GEL HAND SANITIZER FROM Kappaphycus  
alvarezii (SEAWEED) AND COMMERCIAL HAND SANITIZER AGAINST  
Escherichia coli AND Staphylococcus aureus*

grams and a final mass of 0.8 grams after 180 seconds, an average of 0.366 grams per 30 seconds was calculated.

Table 3

*Characterization of K. alvarezii gel hand sanitizer*

Gel Characterization	<i>K. alvarezii</i> Gel Hand Sanitizer	Reference Value
Color	Light Blue	
Odor	Fresh Ocean Breeze	Based on the manufacturer preference
Evaporation Rate	0.366 g/ 30secs	
pH Level	6.1	4.0 to 7.0
Consistency	Loose gel-like	<ul style="list-style-type: none"> <li>• Thin gels could have dribbled away, creating a mess or wasting product; Thick gels slow evaporation process;</li> <li>• Gel-like (loose) consistency could have been easily applied to and spread on the skin</li> </ul>

Table 3 presents the characteristics of the *K. alvarezii* gel hand sanitizer as per its corresponding test and beside these is the reference value according to Booq et al. (2021) for pH level and Bergounhe (2021) for consistency.

## DISCUSSION

### Minimum Inhibitory Concentration (MIC) of *Kappaphycus alvarezii* extract solution

The inhibitory activity of seaweed extract is tested by determining the minimum inhibitory concentration (MIC) that is effective against *Escherichia coli* (S 120423) and *Staphylococcus aureus* (S 082233). The MIC was determined using the liquid dilution method. Dilution methods are considered quantitative tests and are suitable for determining MIC since it allows calculating the quantity of the tested antibacterial agent in the

broth or agar medium (Balouiri et al., 2016 as cited in Vaou et al., 2021). After 24 hours of incubation, turbidity was measured with a spectrophotometer. A spectrophotometer (722N VIS Spectrophotometer) can quantify a substance by measuring its absorbance and transmission when light travels through the cuvette containing the sample (Shidiq et al., 2021). According to the results obtained from the spectrophotometric analysis of minimum inhibitory concentration, the 6% *Kappaphycus alvarezii* extract exhibited maximal inhibitory activity against *Escherichia coli* and *Staphylococcus aureus*.

### **Inhibitory activity of *Kappaphycus alvarezii* extract solution against *Escherichia coli* and *Staphylococcus aureus***

The minimum inhibitory concentration of *Kappaphycus alvarezii* extract solution was determined by testing concentrations of 2%, 4%, 6%, and 8% on both gram-negative bacteria (*E. coli*) and gram-positive bacteria (*S. aureus*). Among the four concentrations tested, the concentration of 6% *K. alvarezii* extract had the lowest average absorbance value of 0.026, indicating the lowest bacterial presence. This value was lower than the negative control at 0.041. The solvent control yielded a value of 0.032, and the positive control had an average absorbance value of 0.042. The 6% concentration was the closest to the standard control with an average absorbance value of 0.021. These results indicate that 6% *Kappaphycus alvarezii* extract solution displayed the minimum inhibitory concentration against the two pathogenic bacteria. This corresponds to the study of Adriani et al. (2016), Pushparaj et al. (2014, as cited in Rima et al. 2022) that *K. alvarezii* extract had a minimum inhibitory concentration of 6%.

### **Inhibitory Activity of Seaweed Gel Hand Sanitizer and Commercial Hand Sanitizer**

Figure 1 had indicated that the seaweed gel hand sanitizer, which contained 6% *K. alvarezii* extract, exhibited an inhibition zone diameter of 16 mm against *E. coli* and 12 mm against *S. aureus* bacteria. Correspondingly, Pushparaj et al.

(2014) had previously reported that the antibacterial activity of *K. alvarezii* against *E. coli* and *S. aureus* resulted in inhibition zones of 8 mm and 9 mm, respectively. Commercial hand sanitizer exhibited an inhibition zone of diameter of 15 mm and 16 mm against *E. coli* and *S. aureus*, respectively.

As per Muleba et al. (2022), in an efficacy assessment conducted, bacterial strains displaying zones of inhibition equal to or greater than the standard zones (observed with commercial hand sanitizer) were deemed sensitive to the hand sanitizer. Conversely, if the zone was smaller, the tested microorganism was considered resistant to the hand sanitizer. Based on the inhibitory activity test, concerning the inhibition of *E. coli* bacterial growth, the seaweed gel hand sanitizer exhibited a larger inhibition zone of 15 mm compared to the commercial hand sanitizer. However, regarding the inhibition of *S. aureus* bacterial growth, the commercial hand sanitizer demonstrated a greater inhibition zone of 16 mm compared to the seaweed gel hand sanitizer's 12 mm. Consequently, *E. coli* was found to be sensitive to the seaweed gel hand sanitizer, while *S. aureus* was resistant to it.

## Characterization

### a. Organoleptic Characteristics

Referring to Michael Edwards' *Fragrances of the World* (n.d.), the gel hand sanitizer possessed a refreshing water fragrance, specifically reminiscent of an ocean breeze. It was characterized by its baby blue or light blue color and had a loose consistency.

Bergounhe (2021) stated that thin gels are easily manageable but could dribble away, creating a mess or wasting the product. Thick gels could have slowed down the evaporation process excessively, resulting in the user having slimy hands for

an extended period or potentially becoming stuck in the packaging. Nonetheless, hand sanitizers had a gel-like (loose) consistency, and this liquid formulation signifies that gel could be easily applied and spread on the skin (Centre of Industrial Rheology, n.d.).

#### b. pH Level

The pH values of the formulated hand sanitizer gels were determined using both a digital pH meter (Model: Multifunctional tester 9909SP) and pH test strips (DF Universal Test Paper). It was observed that both Trial 1 and Trial 2 reflected an average pH level of 6.1. It is recommended that the pH value of topical formulations should fall within the skin's broad pH range, typically ranging from 4.0 to 7.0, to mitigate skin inflammation and irritation (Booq et al., 2021).

#### c. Evaporation Rate

The evaporation rate of a gel hand sanitizer was assessed over a 180-second duration in two separate trials. In Trial 1, the sanitizer's initial mass was 3 grams, which reduced to 0.900 grams after 180 seconds. In Trial 2, with an identical initial mass of 3 grams, the final mass after 180 seconds measured 0.700 grams. The average evaporation rate across both trials was calculated at 0.366 grams per 30 seconds.

### Conclusion

The study aims to assess the effectiveness of gel hand sanitizer derived from seaweed *Kappaphycus alvarezii* compared to commercial hand sanitizer against *Escherichia coli* and *Staphylococcus aureus*. All objectives of the study have been successfully achieved. Initially, the study identifies the optimal concentrations (2%, 4%, 6%, and 8%) of *Kappaphycus alvarezii* extract for inhibiting these bacteria using the liquid dilution method. Subsequently, spectrophotometric analysis is employed to evaluate the inhibitory effects of *K. alvarezii* against both

pathogens. Results indicate that the 6% concentration of the seaweed extract demonstrates the lowest inhibitory activity with an average absorbance of 0.026 against the bacteria. Notably, *Escherichia coli* shows sensitivity to the seaweed gel hand sanitizer, whereas *Staphylococcus aureus* exhibits resistance. The study concludes that there is a significant difference in inhibitory activity between commercial hand sanitizer and *Kappaphycus alvarezii* extract gel hand sanitizer.

### Recommendations (ARIAL, 10pts)

The following recommendations conveys actionable insights gleaned from the study's findings, crafted to benefit the entities directly influenced by the research. It serves as a strategic directive, imparting informed guidance aimed at enhancing practices, policies, or outcomes relevant to the study's focus.

**Seaweed Industry.** Incorporating *Kappaphycus alvarezii* into hand sanitizers can stimulate business growth, create new markets, and increase seaweed demand.

**Seaweed Farmers.** Increased demand for *Kappaphycus alvarezii* can provide financial benefits and market stability for seaweed growers, promoting environmentally friendly farming practices.

**Department of Health (DOH).** Adoption of natural hand sanitizers can improve public health outcomes by reducing chemical exposure and potentially lowering the incidence of skin disorders associated with commercial sanitizers.

**Department of Environment and Natural Resources (DENR).** Promoting seaweed-based sanitizers supports environmental sustainability efforts, reducing chemical pollution and preserving marine ecosystems.

**Food and Drug Administration (FDA).** Understanding the efficacy of natural sanitizers like *Kappaphycus alvarezii* can



facilitate the approval process for new products, offering safer alternatives to the public.

**Children.** Natural hand sanitizers may be gentler on sensitive skin compared to chemical-based options, potentially reducing illness among children.

**General Population.** Access to effective and eco-friendly hand sanitizers benefits everyone by addressing concerns about long-term health and environmental impacts of synthetic chemicals.

**Manufacturers and Commercial Organizations.** Incorporating natural sanitizers into product lines can meet consumer demand for sustainable and skin-friendly products, boosting sales and market share.

**Future Researchers.** Building on this study's findings, future research can explore additional applications for *Kappaphycus alvarezii* in personal care products and contribute to the development of innovative natural solutions across various industries.

The researchers suggest the following as some broad approaches that future researchers may consider following in future studies to maximize the potential of *Kappaphycus alvarezii* extract.

1. **Safety Evaluation:** Rigorous safety evaluations; including tests for skin irritation, sensitization, and cytotoxicity, would be essential to ensure the safety of seaweed gel hand sanitizers for prolonged and repeated use.
2. **Antimicrobial Efficacy Studies:** Further exploration into the antimicrobial properties of seaweed gel hand sanitizers against a wider range of pathogens is recommended. Researchers could conduct investigations to evaluate the effectiveness of these sanitizers against specific bacterial, viral, and fungal strains, including those resistant to conventional sanitizers.

3. **Diversification of Applications:** Beyond hand sanitizers, researchers could investigate other potential uses for seaweed-based antimicrobial gels, such as in wound care, oral hygiene, and surface disinfection. Taking advantage of the seaweed's natural antimicrobial properties could lead to diverse applications in healthcare and personal care.
4. **Formulation Optimization:** Researchers might aim to refine the formulation of seaweed gel hand sanitizers to enhance their effectiveness, stability, and user satisfaction. This could entail testing different seaweed extracts, adjusting concentrations of active ingredients, and exploring additives to improve aspects like moisturization and fragrance.
5. **Market Adoption and Customer Acceptance:** Researchers might examine consumer preferences, perceptions, and acceptance of seaweed gel hand sanitizers in comparison to conventional products. Researchers could offer valuable insights for the consideration of product performance indicators such as fragrance, texture, packaging, and perceived purpose and environmental benefits.
6. **Clinical Testing and Regulatory Approval:** Conducting clinical trials in real-world settings would be necessary to evaluate the efficacy and safety of seaweed gel hand sanitizers, potentially paving the way for regulatory approval for commercialization. Collaboration with regulatory bodies would be key to meeting standards and requirements for marketing and distribution.

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# **Crime Prevention Strategies along Academia Drive: Basis for Integrated Crime Prevention Program**

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## **KEYWORDS:**

- **Crime Prevention**
- **Philippine National Police**
- **Barangay**
- **Business**
- **Academia Drive**

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**Abstract.** A vital component of keeping communities safe and secure is crime prevention, which focuses on preventive approaches to fight crime and discourage possible criminal activities. This study focused on the crime prevention strategies along Academia Drive as the basis for an integrated crime prevention program. Ninety-five (95) respondents participated in this study comprising of 20 personnel from PNP-

Dasmariñas, 20 barangay officials from Barangay Buroi Main, and 55 employees and owners from business establishments. The mixed-method research design was used to determine the crimes committed along Academia Drive as well as the crime prevention strategies implemented, challenges experienced, and improvements that the respondents suggest. Findings showed that theft had the highest frequency of being committed at 34.19%. The PNP-Dasmariñas, Barangay Buroi Main, and business establishments highly implemented proactive strategies to deter crime. In terms of challenges encountered,

both PNP-Dasmariñas and Barangay BuroI Main encountered lack of personnel as a challenge. On the other hand, the business establishments encountered moderate problems in several aspects including absence of security service, lack of knowledge on crime prevention, and insufficient equipment and materials for the implementation of crime prevention. Several recommendations were provided to improve crime prevention implementation along Academia Drive.

# **Crime Prevention Strategies along Academia Drive: Basis for Integrated Crime Prevention Program**

## **INTRODUCTION**

Crime prevention is an essential aspect of maintaining safe and secure communities around the world. The focus of crime prevention is to reduce the incidence of criminal activity in society. Crime prevention measures are aimed at reducing the opportunities for crime to occur, as well as addressing the underlying causes of criminal behavior. The focus of crime prevention has shifted over time from a reactive approach, which involves responding to crimes after they have occurred, to a proactive approach, which seeks to prevent crimes before they happen (Drew, 2020). According to Austria and Diaz (2019), the overall purpose of crime prevention is public safety and security, as it provides a more compassionate and economical way of tackling the issues of crime.

In the Philippines, national and local governments implement programs and strategies to prevent criminal activity from occurring. According to the 2020 Cavite Ecological Profile, the City of Dasmarinas recorded 1065 total crimes in 2018, with 346 index crimes and 719 non-index crimes. In 2019, there were 1,326 total crimes, of which 274 were index crimes and 1,052 were non-index crimes. In 2020, there were 1,131 total crimes, of which 227 were index crimes and 904 were non-index crimes. It is evident that the City of Dasmariñas has a high crime incidence rate, likely due to its highly urbanized setting.

The Governor's Drive, Mangubat Avenue in Barangay Buroi Main, City of Dasmariñas, sometimes called Academia Drive, is surrounded by schools, attracting business owners to operate their businesses in the area. Academia drive stretches from the Aguinaldo Highway to Governor's Drive, Mangubat Avenue, where the National College of Science and Technology is located, all the way to De La Salle University-Dasmarinas. Due to the fact



that the City of Dasmariñas is a highly urbanized city, it is evident that many people move back and forth in the city, the so-called transient people. This "transient population" often relocates or changes their place of residence for work, personal, or other temporary reasons. With colleges and universities along Mangubat Avenue, many people, especially students who have not been there from the beginning, are staying in dormitories for academic purposes.

In order to attain a peaceful and safe community, crime prevention strategies are necessary which leads this study to focus on determining the crime prevention strategies implemented by the Philippine National Police (PNP) Dasmariñas, barangay officials, and business establishments along the academia drive. These strategies which will serve as a basis for integrated crime prevention strategies in the City of Dasmariñas, Cavite. This study seeks to provide relevant information that can be utilized by different communities.

### **Objectives of the Study**

This study aims to:

1. determine the crimes committed along the academia drive;
2. determine the crime prevention strategies employed by the respondents along the academia drive;
3. identify the challenges encountered by the respondents in the implementation of crime prevention strategies along the academia drive, and;
4. determine the improvements in crime prevention based on the respondents' perspectives.

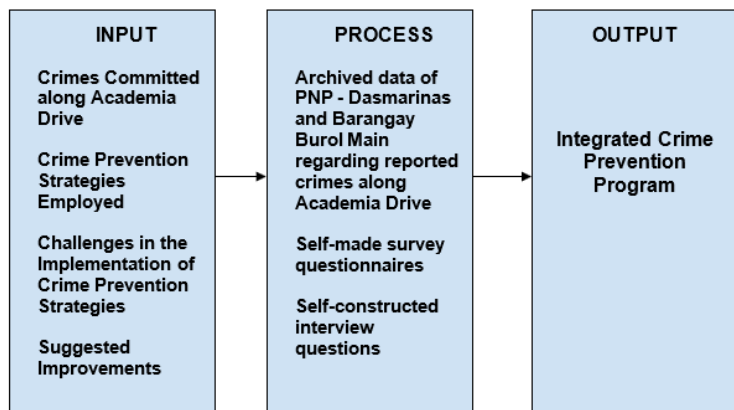
### **Theoretical Framework**

This research is based on the Routine Activity Theory by Cohen and Felson (1979), which highlights the convergence of these three variables as the cause of crime: (1) a potential offender; (2) a sustainable target; and (3) the absence of a capable guardian. It mentioned that all the elements need to come together for crime to be achieved. This theory relies on the Rational Choice Theory, which holds that criminals are logical in

their decision-making, criminal activity is anticipated whenever a choice is made, and the advantages of committing a crime surpass the apparent costs of the action. It also considers contextual and situational variables, such as an urgent need for money, as well as the benefit of committing a crime compared with the rewards of legal action. To put it into perspective, the absence of any of these elements is sufficient to deter the occurrence of crime (Kitteringham & Fennelly, 2020).

## Conceptual Framework

Figure 1 below shows the interaction of the variables under study. The researchers used the input, process, and output (IPO) model, wherein the input consists of the following variables that need to be determined: crimes committed along Academia Drive, crime prevention strategies, challenges in the implementation of crime prevention, and suggested improvements. The process includes the utilization of archived data of reported crimes along Academia Drive from PNP-Dasmarinas and Barangay Buroi Main, administration of survey questionnaires, and conduct of interviews. The final output of the study is the integrated crime prevention program than can be implemented along Academia Drive.



*Figure 1. Paradigm of the Study*

## Scope and Limitation

The study focused on determining the crime prevention strategies along Academia Drive as a basis for an integrated crime

prevention program in the City of Dasmariñas, Cavite. This study involved 95 participants, which comprised of 20 PNP personnel from the Dasmariñas City Police Station, 20 barangay officials from Barangay Buroi Main, and 55 business establishments located along Academia Drive. The study focused on the Academia Drive, which covers the area from the Aguinaldo Highway to Governor's Drive along Mangubat Avenue where the National College of Science and Technology is located, all the way to De La Salle University-Dasmariñas and did not explore other areas.

## **Review of Related Literature**

### *Crime and Causation of Crime*

Republic Act. 3815 also known as the Revised Penal Code, defines crimes as violations of rules or laws through an act or omission. In criminal law, there are three distinctions between crimes; they differ based on what law is penalizing them. The first, felonies, are crimes that are punishable under the Revised Penal Code. Second, offenses are punishable under special penal laws. And lastly, infractions or misdemeanors that are punishable by city or municipal ordinances.

According to Opp (2020), crimes are defined as behaviors that contravene criminal law, acts that are blameworthy and condemned by the public and sanctioned by the state. On the other hand, Dimkov (2019) defined crime as the transgression of moral laws and ethical standards. Law-violating behavior is the result of thoughtful preparation and planning; offenders tend to commit criminal acts if they believe that the risk outweighs the reward and that, after considering the cost and benefits and believing that they will not maximize their benefits, rational individuals ought not to commit crimes (Burt, 2019). For many people, committing a crime is a more preferable choice than abiding by the law, as it brings desirable outcomes without lengthy work. Based on Wikström (2019), the theory of Situational Action Theory (SAT) states that crimes are perpetrated because of a lack of deterrence factor, and as a consequence, it is more convincing or more practical to commit a crime. It is also stated here that due to pressure from peers or others (lack of self-control), they tend to commit crimes.

### *Crime prevention and practices*

In a study conducted by Piroozfar et al. (2019), it was discovered that criminal behavior, victimization, and crime are all examined in environmental criminology in light of their ties to specific locations. The use of Crime Prevention Through Environmental Designs (CPTED) in Brixton Town Centre reveals that effective lighting systems, signage, sightlines, CCTV, and territoriality all had a significant impact in reducing and preventing crimes in the neighborhood, and it was concluded that crime rates had dropped significantly since the use of interventions. The audit and survey results showed that the signs and CCTV cameras are the CPTED components in the town center that require improvement.

In a related study, Vicente et al. (2020) determined how the Philippine National Police and barangay officials in Baguio City prevent crime. Frequent patrolling, routine checkpoints, and seminars on crime prevention were all carried out. Since patrolling is the principal activity carried out by the implementers, it was the activity that the community observed and felt the most. Patrol officers chose crime-prone areas to undertake to patrol, while the barangay's effort was deploying tanods out on foot patrol at night. It was recommended that the PNP, barangay officials, and the community hold frequent meetings to improve their working relationship as well as hold awareness seminars on crime prevention and the BCPO Station 3's standard operating procedure for crime reporting to encourage the community to participate actively.

Crimes against property were a problem in Poblacion Pikit, Cotabato, as noted by Kadatuan et al. (2021). Due to the high frequency of property crimes in the area, the researchers tend to determine the basic crime prevention practices of the residents. The study by Kadatuan et al. (2021) found that 46% of the respondents had attended crime-related seminars, 18% had attended gun-related seminars, 12% had attended robbery-related seminars, 10% had attended a sexual-related seminar, and 4% had attended a property-crime-related seminar. The respondents also concurred that the following crime prevention measures efficiently prevent and avoid crimes: use of technology, crime prevention through environmental design (CPTED), physical monitoring, and countering crime against property. The study came to the conclusion that the respondents highly agreed

that the most effective practices to prevent crime include the installation of CCTV cameras, defensible space, having the community chairman create regulations regarding perpetrators, having police patrols constantly aware of the citizens, and regularly checking the barangay.

### *Challenges in implementing crime prevention strategies*

In Nigeria, given that police lack the manpower and resources to successfully police rural areas, community participation in crime prevention is necessary (Arisukwu et al., 2020). It was found that there is a low police presence and patrols in the area. In order to reduce crime, the police and the community must work together through community policing. Additionally, the introduction of CCTV will improve Nigeria's rural law enforcement policy.

In Baguio City, a study by Vicente et al. (2020) found that depleted personnel and a lack of equipment posed challenges in the conduct of crime prevention activities in the community. Vicente et al. (2020) noted that due to a lack of police personnel, most patrol efforts were done using automobiles, and foot patrols were rarely conducted. Additionally, it was seen that Sanguniang Kabataan (SK) was inactive, and the local community lacked volunteers. Moreover, insufficient equipment and materials, such as a lack of crime prevention paraphernalia in barangay tanods and a lack of streetlights within the area, were identified as challenges. Active participation of barangay officials as well as volunteers and Sanguniang Kabataan and requests for assistance in the provision of equipment such as batons, flashlights, raincoats, and boots, together with the additional streetlights, were recommended to solve the issues raised.

Ayeo-Eo and Repoyo (2020) discovered that the problems encountered in the implementation of crime prevention programs in selected barangays of Cabanatuan City were a lack of resources, providing funds to barangay tanods, and the inability of the barangay residents to cooperate. In a recent study by Doquilla et al. (2023) in the same city that determined the level of implementation, effectiveness, and challenges encountered by the Barangay Peacekeeping Action Team (BPAT) of selected barangays in the area, it was found that there were difficulties like a lack of communication, equipment, training, and cooperation with the PNP. To address the issues identified in the study, it was

suggested that the skills of BPAT be honed through training and seminars, that equipment be added, and that proper coordination and collaboration with the PNP be practiced.

### *Synthesis*

Based on the related literature and studies, it was found that conducting regular patrols, checkpoints, or inspections, reprimanding, issuing tickets, and furnishing society with knowledge about crime control strategies by the law enforcement agency and collaboration with the society of the law enforcement agency notably helped to prevent crimes (Ayeo-Eo & Repoyo, 2020; Galabin et al., 2021; Vicente et al., 2020; Kadatuan et al., 2021; Diaz & Austria, 2019). Further literature states that crime prevention through environmental designs significantly reduces crime commissions; some of the designs that were effective are lighting systems, signage, sightlines, and CCTVs (Piroozfar et al., 2019; Piza et al., 2019; Rupp et al., 2020). On the other hand, the primary causes that hinder the implementation of crime prevention strategies are a lack of resources, inadequate personnel, training, and knowledge in our law enforcement agencies, and lastly, low visibility of the police (Vicente et al., 2020; Ayeo-Eo & Repoyo, 2020; Doquilla et al., 2023; Arisukwu et al., 2020).

Researchers have likewise focused on crime prevention strategies to prevent crime from occurring. No research was found that determines the crime prevention strategies along the Academia Drive; hence, this study is proposed to target this gap.

## **METHODOLOGY**

The study utilized the mixed method research to gather data. Mixed method research is an approach that integrates qualitative and quantitative research methods in a single study. It employed the quota sampling technique to select the respondents. Quota sampling involves creating a quota of respondents that will participate in this study. The total number of respondents in this study is 95 comprising of 20 police officers from Dasmarinas City Police Station, 20 barangay officials, and 55 employees from business establishments operating along Academia Drive.

The study employed three data collection tools: (1) archived data from the Philippine National Police-Dasmarinas and

Barangay BuroI Main, identifying common crimes committed along Academia Drive; (2) researcher-made survey questionnaires that measured the same variables, but contents were tailor-fit to each group of respondents; and (3) interview guide to further elaborate on and support the participants' responses in the survey questionnaires. Three panels of experts reviewed the questionnaire and interview guide to ensure their validity. The questionnaire was then pre-tested to 20 PNP officers, 20 barangay officials, and 20 business owners/employees of business establishments, who are not included in the study, to ensure its reliability. The Cronbach alpha score of the questionnaire was computed after summarizing the pre-test results. The questionnaire for police officers obtained a reliability score of .71, the questionnaire for barangay officials had a reliability score of .86, and the questionnaire for business establishments had a reliability score of .83.

Prior to the data gathering, the researchers sought permission from the PNP-Dasmariñas and Barangay BuroI Main to gather information regarding crimes committed along Academia Drive. The researchers conducted an in-person survey and interview subsequent to the research adviser's consultation and approval. Consent forms were prepared and secured for the approval of the respondents, and the respondents were given assurance of the confidentiality of the data.

The researchers used mixed-method data analysis, which entails gathering and evaluating both quantitative and qualitative data to gain a better understanding of a phenomenon. For quantitative part of the study, frequency and percentage distribution, and mean were used, while content analysis was used for the qualitative part. Each interview was transcribed verbatim and reviewed by the proponent of the research to gain a general understanding of the context.

### ***Ethical Consideration***

The researchers assured the voluntary participation of the respondents in this study and provided them with sufficient information about taking part in this study. They also considered the confidentiality and anonymity of the respondents. The research was subjected to ethics review and was given clearance

certification by the Institutional Ethics Review Board through EACC ERC No. 2023-01-088.

## RESULTS

This section presents the results of the study.

Table 1

*Crimes usually reported to the PNP- Dasmariñas from January 2022 – June 2023*

Crimes	Frequency	Percentage
Physical injury	4	50%
Carnapping	2	25%
Damage to property	1	12.5%
Comprehensive law on firearms and ammunition	1	12.5%
<b>Total</b>	<b>8</b>	<b>100%</b>

Table 1 shows the rate of crimes usually reported to the PNP-Dasmariñas that are committed along the Academia Drive from January 2022 to June 2023 (18 months). Data shows that the total number of recorded crimes was eight (8). Physical injury obtained the highest frequency which holds the highest percentage of 50%, followed by carnapping with 25%. Damage to property and comprehensive law on firearms and ammunition were the least cases reported to the PNP-Dasmariñas.



Table 2

*Crimes usually reported to the Barangay Buroi Main from January 2022 to June 2023*

<b>Crimes</b>	<b>Frequency</b>	<b>Percentage</b>
Theft	53	34.19%
Physical injury	39	25.16%
Robbery	30	19.35%
Vehicular accident	8	5.16%
Alarms and scandal	7	4.52%
Drug-related cases	6	3.87%
Carnapping	5	3.23%
Malicious mischief	5	3.23%
Acts of lasciviousness	2	1.29%
<b>Total</b>	<b>155</b>	<b>100%</b>

Table 2 shows the rate of crimes usually reported to the Barangay Buroi Main that are committed along the Academia Drive from January 2022 to June 2023 (18 months). Data shows that the total number of reported crimes was 155. Theft obtained the highest frequency which holds a percentage of 34.19%, physical injury with 25.16%, and robbery with 19.35%. Vehicular accident, alarms and scandal, drug-related cases, carnapping, malicious mischief and acts of lasciviousness were the least reported crimes.

Table 3

*Crime prevention strategies employed by the PNP-Dasmariñas along the Academia Drive*

<b>Crime Prevention Strategies</b>	<b>Mean</b>	<b>Interpretation</b>
1. Conduct of patrol during daytime along Governor's Drive Mangubat Avenue, Barangay Burot Main	4.0	Highly implemented
2. Conduct of patrol during nighttime along Governor's Drive Mangubat Avenue, Barangay Burot Main	4.0	Highly implemented
3. Coordinating with barangay officials in conducting crime prevention awareness to the public.	4.0	Highly implemented
4. Deploying police personnel in crime-prone areas to intensify and increase police visibility.	4.0	Highly implemented
5. Intensifying security and protection for all by installing CCTV surveillance cameras in crime-prone areas.	2.15	Somewhat implemented
6. Conduct seminars to barangay tanod on Anti-Crime Program of the PNP	4.0	Highly implemented
7. Carry out Police Community Relation to encourage the public to report suspicious group or people or individual in their neighborhood	4.0	Highly implemented
8. Strict implementation of ordinances such as violation of curfew for minors and drinking in public places.	4.0	Highly implemented
<b>Overall</b>	<b>3.77</b>	<b>Highly implemented</b>

Legend: 3.26-4.00 – Highly implemented, 2.51-3.25 – Moderately implemented, 1.76-2.50 – Somewhat implemented, 1.00-1.75 – Not implemented

Table 3 reveals that PNP-Dasmariñas highly implemented crime prevention strategies with an overall mean of 3.77. It can be inferred from the results that the agency actively implements proactive strategies to keep peace and order along the Academia Drive such as conduct of patrol during daytime and

nighttime along Governor's Drive Mangubat Avenue in Barangay Buroi Main, coordination with barangay officials in conducting crime prevention awareness to the public, and others. Meanwhile, intensifying security and protection for all by installing CCTV surveillance cameras in crime-prone areas obtained the lowest mean of 2.15 which means that this strategy is somewhat implemented.

To support these quantitative data, the researchers asked three respondents through an in-person interview to share the crime prevention strategies they implement along Mangubat Avenue. Their responses revealed five (5) highly implemented crime prevention strategies - patrolling, police visibility, police omnipresence, information campaign, and coordination with the barangay. Their responses are briefly discussed in the succeeding paragraphs.

#### *Patrolling*

Two police officers stated that they conduct mobile patrolling in the area on different schedules as one of the crime prevention strategies. The participants stated:

*"...sa police mobile patrolling, pina-patrolya niyan yung buong lugar ng Mangubat Avenue..."*

*"Una sa lahat, yung pinakabasic natin is yung mobile patrol natin, nagka-conduct ng patrol sa area, iniiba iba natin ang time skip kung kelan magpa-patrol kasi baka ma-trace...."*

#### *Police visibility*

The police officers mentioned that they stay in one area on specific schedules in addition to patrolling. This was done specially during rush and busy hours, as reflected in their statements:

*"...police visibility, nagkakaroon tayo stationary police visibility dun sa area and may specific schedules nga lang..."*

*“...pagkakaroon ng police visibility doon sa area, kung saan hindi nagpapatrol yung isang personnel doon or dalawang personnel kundi nags-stay doon sa area, lalo na kung tinatawag natin mga rush hours, saka yung mga labasan ng mga estudyante, dagsa ng mga tao, uwian. ...”*

### *Police omnipresence*

The police officers also mentioned that they deploy a police personnel in civilian clothes to immerse in the community to conduct surveillance. The participants stated:

*“... police omnipresence...yung mga civilian in clothes na pulis na nagpapatrolya in beat patrol kung tawagin natin, so pag sinabi nating beat patrol naglalakad lang or naglilibot-libot na dun sa area...”*

*“...yung omnipresence, isa din yan, maliban sa mga uniformed personnel natin na naka kalat doon sa area, meron tayong non-uniformed personnel na nakakalat doon... as in naka sibilyan silang suot pero police personnel natin sila, nagka-conduct sila doon ng surveillance, nagb-blend in doon sa mga tao....”*

### *Information campaign*

A police officer mentioned that they endeavored to conduct crime prevention information campaign for the awareness of victims and the public, as reflected in the statements:

*“information campaign... Sinasabihan namin yung public, usually kasi mga victim dyan mga estudyante, nire-remind namin sila na i-limit nila yung paglabas ng valuable items sa public, kasi yung mga perpetrators may chance yan diba, pag wala silang makukuha, wala silang nakikitang cellphone o kaya alahas o yung ibang valuable items, walang mangyayaring krimen kasi wala naman sila makukuha eh...”*

### *Coordination with the barangay*

Another police officer stated that they coordinate with the barangay so the barangay police can augment to community patrolling especially during the night. According to the participant:

*“...isa pang improvement ay yung coordination with the barangay, kasi malaki ang Mangubat Avenue, so hindi lahat yun masasakop ng personnel na naka assign doon kaya nakipagtulungan yung barangay na nakasakop don which isa na dun yung Barangay Buro Main, kung saan nagka-conduct din sila ng patrol lalo na sa gabi...”*

Table 4

*Crime prevention strategies employed by Barangay BuroI Main along Academia Drive*

<b>Crime Prevention Strategies</b>	<b>Mean</b>	<b>Interpretation</b>
1. Conduct of patrol during daytime along Governor's Drive, Mangubat Avenue, Barangay BuroI Main	4.0	Highly implemented
2. Conduct of patrol during nighttime along Governor's Drive, Mangubat Avenue, Barangay BuroI Main	4.0	Highly implemented
3. Coordinating with local police in conducting crime prevention awareness to the public	4.0	Highly implemented
4. Deploying barangay tanods in schools, hospital, and other related public areas	4.0	Highly implemented
5. Intensifying security and protection for all by installing CCTV surveillance cameras in crime-prone areas	3.45	Highly implemented
6. Maintains that jurisdiction is well-lighted of streetlights	3.5	Highly implemented
7. Strict implementation of ordinances such as violation of curfew hours for minors and drinking in public places.	4.0	Highly implemented
<b>Overall</b>	<b>3.85</b>	<b>Highly implemented</b>

Legend: 3.26-4.00 – Highly implemented, 2.51-3.25 – Moderately implemented, 1.76-2.50 – Somewhat implemented, 1.00-1.75 – Not implemented

Table 4 reveals that Barangay BuroI Main highly implements crime prevention strategies as reflected in the overall mean of 3.85. Specifically, they highly implement conducting patrol during daytime and nighttime along Governor's Drive Mangubat Avenue, Barangay BuroI Main, coordinating with the local police in conducting crime prevention awareness to the public, deploying barangay tanods in schools, hospitals, and other related public areas, and strictly implementing ordinances such as violation of curfew hours for minors and drinking in public places. Meanwhile, intensifying security and protection for all by installing

CCTV surveillance cameras in crime-prone areas obtained the lowest mean yet considered as highly implemented.

To support the quantitative data, the researchers asked three respondents through an in-person interview to share the crime prevention they are using within their jurisdiction. Their responses led to a common strategy which is *Barangay Visibility along Academia Drive*. This strategy was achieved through the roving of barangay tanods and the deployment of men in uniform and civilian clothes to watch and protect students and business establishments. The participants stated:

*“...pang karaniwan kasi ang nangyayari dyang krimen sa Mangubat, kaya ang ginagawa namin, yung roving ng tanod lalo sa tapat ng Emilio Aguinaldo at tsaka ng SMDC, nagtatalaga na kami minsan dyan ng men in uniform at tsaka men in.. ah walang uniform at least para mabantayan, mapangalagaan lalong-lalo na yung mga estudyante...”*

*“Ang number one kasi eh is ah barangay visibility diba, kaya ako nagpapatupad ng barangay visibility along Mangubat avenue kasi dyan yung number one na napakadaming student at establishmen...”*

*“Ang pagro-roving ng mga tanod sa mga lugar para maiwasan ang maraming insidente o krimen na nangyayari sa barangay”*

According to Figer (2023), the barangay has an obligation to its jurisdiction, providing services to its people, and maintaining law and order within its boundaries.

Table 5

*Crime prevention strategies employed by businesses along Academia Drive*

<b>Crime Prevention Strategies</b>	<b>Mean</b>	<b>Interpretation</b>
1. Ensuring that doors and windows are in good state of repair	3.65	Highly implemented
2. Provides training for all employees on security procedures	3.32	Highly implemented
3. Conduct regular risk assessments and operational security checks	3.43	Highly implemented
4. Posting of signages for crime awareness and safety	2.92	Moderately implemented
5. Upgrading and adding additional locks for windows and doors	3.56	Highly implemented
6. Deployment of security personnel or guards	2.45	Somewhat implemented
7. Installment of lights, emergency, and security devices such as CCTV surveillance cameras and alarms	3.90	Highly implemented
8. Collaborating with the local police and barangay officials for additional security within the premises	3.27	Moderately implemented
<b>Overall</b>	<b>3.31</b>	<b>Highly implemented</b>

Legend: 3.26-4.00 – Highly implemented, 2.51-3.25 – Moderately implemented, 1.76-2.50 – Somewhat implemented, 1.00-1.75 – Not implemented

Table 5 reveals that business establishments along Academia Drive highly implemented crime prevention strategies as reflected in the overall mean of 3.31. Specifically, they implement the installation of lights, emergency, and security devices such as CCTV surveillance cameras and alarms as well as they ensure that doors and windows are in good condition. Meanwhile, they moderately implement collaborating with the local police and barangay for additional security. Lastly, the



deployment of security personnel or guards obtained the lowest mean, which means that this strategy is somewhat implemented.

To support the quantitative data, the researchers asked three respondents through in-person interviews to share the crime prevention strategies they used in their business establishment. Based on their responses, business establishments rely on CCTVs as their main tool for crime prevention. Their main purpose is to achieve a sense of security and eliminate the possibility that a crime can be committed. The installation of CCTV surveillance cameras is reflected in the following statements from the participants:

*"Dito ang ginagawa ko may CCTV kami sa loob ng store tsaka sa labas, yung CCTV sa labas nakatutok yan sa may entrance para makita kung sino yung mga pumasok at lumabas, meanwhile dito sa loob yung mga CCTV nakatutok siya kung saan hindi ko na kita kung saan yung cashier ko, yun yung meron ako dito."*

*"I think ang effective among sa mga crime prevention na nai-implement, CCTV, okay, installation ng CCTV sa labas at sa loob ng store..."*

*"... dito sa shop, may iilan akong CCTV dahil maliit lang naman tong puwesto ko, kasi yan talaga yung primary security tool na talagang malaking tulong sa pag pigil at saka panakot na rin sa mga masasama ang loob."*

Table 6

*Challenges encountered by the PNP-Dasmariñas in the implementation of crime prevention strategies along Academia Drive*

<b>Challenges</b>	<b>Mean</b>	<b>Interpretation</b>
1. Lack of knowledge about crime prevention strategies	1.0	Not at all a problem
2. Poor coordination with barangay officials with regards to crime prevention measures	1.0	Not at all a problem
3. Lack of community partnership to achieve effective community policing	1.8	Minor problem
4. Absence of CCTV surveillance camera	3.1	Moderate problem
5. Absence of streetlights	1.8	Minor problem
6. Defective materials such as flashlights and blinkers	1.65	Not at all a problem
7. Lack of personnel that could be deployed in the area	3.3	Serious problem
<b>Overall</b>	<b>1.95</b>	<b>Minor problem</b>

Legend: 3.26-4.00 – Serious problem, 2.51-3.25 – Moderate problem, 1.76-2.50 – Minor problem, 1.00-1.75 – Not at all a problem

Table 6 reveals that the PNP-Dasmarinas encountered a minor problem in terms of the implementation of crime prevention strategies. However, they raised that the lack of personnel that could be deployed in the area was a serious problem, followed by the absence of CCTV surveillance camera as a moderate problem. Meanwhile, the lack of knowledge about crime prevention strategies, and having poor coordination with barangay officials with regards to crime prevention measures have not been a problem for the agency.

To support the quantitative data, the researchers asked three respondents through in-person interviews to share the challenges they experienced within their jurisdiction. Based on their responses, the lack of police personnel, lack of public cooperation, and lack of CCTVs were the challenges encountered by the PNP-Dasmarinas which were consistent with the results of

the survey. Their responses are briefly discussed in the succeeding paragraphs.

#### *Lack of police personnel*

The police officers mentioned that they lack personnel that could be deployed in different areas in the City of Dasmariñas. They mentioned that the police-community residents' ratio is 1:3000. The city has only 186 police personnel as of this time of writing and is not enough to protect the entire community. According to the participants:

*“Unang una don ang isa sa mga pagsubok na kinakaharap namin sa pagpapatupad ng crime prevention is... kakulangan namin sa tao, sa laki ng Dasmariñas, meron lang naman kaming 186 na personnel na nakaduty dito sa Dasmariñas City Police Station, which is isa siya sa malaking factor na nakaka-affect sa pagpapatupad ng crime prevention kasi kulang kami sa tao...”*

*“...lack of personnel, kasi, dito kasi sa Dasmariñas, sa laki ng population ng dasmarinas, ang ration natin is 1:3000, ibig sabihin yung isang pulis sa 3000 na tao, kasi kulang na kulang tayo dito, ang pulis natin dito 186 lang tayo...”*

#### *Lack of public cooperation*

The police officers mentioned that they find the public uncooperative when it comes to preventing crime and prosecuting criminals. The participants stated:

*“...cooperation ng mga citizen... once na makahuli sila ng tao o gumawa ng krimen, halimbawa na lamang sa theft incidents yung mga mandurukot, pagdating nila ng station, kapag ka nabawi na nila yung gamit nila, hindi na nila tinutuluyan o sinasampahan ng kaso yung suspect dahil nga ayaw nila ng abala... at ano pang hassle na gagawin pa sa pagsasampa ng kaso, isa sa mga factor yun kasi once na binitawan natin yung tao sa society, possible na babalik ulit yon at gagawin ulit yung same na krimen na ginagawa niya sa area.”*

*“Ang problemang kinakaharap namin sa Mangubat Avenue... lack of cooperation ng public, kasi kahit anong reminders ng PNP natin dito sa Dasmaringas... hindi naman nila sineseryoso hindi sila naniniwala, binibilinan natin sila na wag nilang ilabas yung mga valuable items nila, eh continuous pa rin...”*

*“...lack of information nila doon sa ginagawang crime, kasi marami pa ring mga bata or estudyante na hindi pa rin alam kung anong klaseng krimen yung ginagawa or paano gawin, gaya na doon yung mga bago yung mga duradura, salisi, meron yung pinaka sikat yung riding in tandem.”*

#### *Lack of CCTVs*

A police officer also mentioned that lack of CCTVs especially in crime-prone areas is one of the problem along Mangubat Avenue. This deficiency provides the offenders an avenue to attack the vulnerable population – the students. The participant stated:

*“..kakulangan sa installation ng mga CCTVs sa mga areas kung saan prone yung mga mandurukot, budol or yung mga krimen na usually lang naman na common nangyayari sa daan lalo na sa mga estudyante kasi along Mangubat Avenue puro mga estudyante dyan kasi mga schools, EAC, Lasalle...”*

Table 7

*Challenges encountered by Barangay BuroI Main in the implementation of crime prevention strategies along Academia Drive*

Challenges	Mean	Interpretation
1. Lack of knowledge about crime prevention strategies	1.2	Not at all a problem
2. Poor coordination with local police with regards to crime prevention measures	1.2	Not at all a problem
3. Absence of CCTV surveillance camera	1.3	Not at all a problem
4. Absence of streetlights	1.4	Not at all a problem
5. Defective materials such as flashlights and blinkers	1.3	Not at all a problem
6. Lack of personnel that could be deployed in the area	2.8	Moderate problem
<b>Total</b>	<b>1.53</b>	<b>Not at all a problem</b>

Table 7 reveals that the Barangay BuroI Main have not much problem in terms of the implementation of crime prevention strategies as reflected in the overall mean of 1.53. However, they perceived the lack of personnel that could be deployed in the area as a moderate problem.

To support the quantitative data, the researchers asked three respondents through in-person interviews to share the challenges they experienced within their jurisdiction. Based on their responses, frequent stealing and lack of personnel were the common challenges.

### *Frequent stealing*

Barangay officials stated that frequent stealing or snatching incidents occurred along Mangubat Avenue, and students were prone to being the victims. Cellphones and gadgets have been the most frequent target among offenders as mentioned by the participants:

*"Actually ang number one namin dito yung snatching, pangkalimitan ang mga nangi-isnatch di naman di naman taga-rito, yung mga dayo na tsine-chempuhan yung mga estudyante, number one target talaga nila estudyante at marunong ah, for the record, ang binabanatan nila panay iPhone, okay, minsan cellphone lang minsan binabatak yung bag, okay, pagka alam nila na may ganong gadget na alam nila, pangkalimitan kasi ang nawawalan dyan yung HSI, yung lasalle na medical course, kaya yun ang number one namin ngayon yung snatching."*

*"Ang pinakamalaking problema namin dito yang Gov. Mangubat, number one is yung incident... snatching incident"*

#### *Lack of personnel*

A barangay official stated that they lack barangay tanod that can be deployed in the area. Sometimes, no barangay tanod was on duty due to the lack of personnel who will go on shifts. According to the participant:

*"Kakulangan ng mga nagbabantay sa mga tanod talagang kulang kami sa tanod tsaka yung mga oras na ... wala rin sila minsan kasi kulang sa nagbabantay yun...."*

Table 8

*Challenges encountered by business establishments in the implementation of crime prevention strategies along the Academia Drive*

Challenges	Mean	Interpretation
1. Lack of knowledge about crime prevention	3.01	Moderate problem
2. Insufficient equipment and materials relative to the implementation of crime prevention	3.01	Moderate problem
3. The premises is not well-lighted	2.8	Moderate problem
4. Poor coordination with the barangay officials and local police with regards to securing the area	2.85	Moderate problem
5. Absence / defective CCTV surveillance cameras	2.96	Moderate problem
6. Absence of security service	3.03	Moderate problem
<b>Overall</b>	<b>2.94</b>	<b>Moderate problem</b>

Table 8 reveals that the business establishments along Academia Drive encountered moderate problems in the implementation of crime prevention strategies as reflected in the overall mean of 2.94. The absence of security service, the lack of knowledge about crime prevention, and the insufficient equipment and materials relative to the implementation of crime prevention were among the challenges with high mean scores.

To support the quantitative data, the researchers asked three respondents through in-person interviews to share the challenges they were experiencing in their business establishment. Their responses pointed out the *insufficient equipment* as a common challenge. In particular, the business owners stated that they have CCTVs in their establishments, but they found this equipment to be insufficient, malfunctioning and needed upgrading, or with poor quality. For them to acquire CCTVs with better quality, they have to allocate a higher budget for its acquisition. The participants stated:

*“Usually ang nagiging problema mo dyan pag yung ininstall mo na CCTV ay wifi connected tapos nawalan ka ng wifi., kunwari nagmo-monitor ka sa cellphone, pag nawala ang wifi mawawala yung connection... talagang gusto mong walang problema, papakabit ka ng mga high-end na CCTV na kahit na may power interruption, may bagyo, walang problema.”*

*“Siguro ang mga pagsubok na kinakaharap ng shop ko eh budget talaga, kasi tatlo lang yung CCTV ko, hindi kasi ako kampante na iilan lang to, mas maige siguro kung makakapag upgrade or makakapagdagdag ako ng CCTV dito sa shop ko, gusto ko rin kasing lagyan yung sa labas ng shop ko para kita lahat ng pangyayare sa sa shop ko 24/7....”*

*“Ang problem siguro may mga CCTV nga ako dito pero medyo malabo kasi di naman kamahalan yung bilin ko dyan, so pag nire-review ko yung CCTV tuwing gabi medyo hindi okay yung video.”*

### **Improvements in Crime Prevention: Respondents' Perspectives**

The researchers asked nine respondents through in-person interviews about their suggestions to improve crime prevention along Mangubat Avenue. Three respondents came from the Philippine National Police - Dasmariñas, three barangay officials of Barangay Burol Main, and three business owners along Mangubat Avenue. The common suggestions included additional personnel, patrolling, conduct of seminar, public cooperation, additional CCTV surveillance cameras, and additional streetlights. Their responses are briefly discussed in the succeeding paragraphs.

#### *Additional personnel*

Three respondents suggested to provide additional personnel in the police force and barangay police force. Insufficient personnel mean a lack of human resources; thus, it can be a hindrance to the implementation of crime prevention strategies. Additional personnel may improve not only the



implementation of crime prevention strategies but also the deterrence of crime. According to the participants:

*“...karagdangang pulis karagdagan sa civilian, volunteer, at tsaka karagdangang tanod. mahirap kasi sa part namin malaki yung nasasakupan namin dito malaki yung part ng barangay...”*

*“...magkaron ng karagdangang deployment ng pulis at ng barangay para at least full force ang tropa in case magkaron ng problema, batuhan lang kami ng radyo, madali namin ma-intercept yung mga tawag, kasi dito talaga kulang, kulang na kulang kami...”*

*“Karagdagan ng tanod at tsaka pa-igtingin ang curfew hours para sa mga menor de edad.”*

#### *Patrolling*

Two respondents suggested the increased presence of the police and barangay tanod through foot patrolling within the vicinity. Patrol is a preventive measure implemented by police and barangay organizations as their main tool in preventing crime. The main objectives of patrolling are to deter crime and easily apprehend criminals once they are caught committing crime. The participants stated:

*“...siguro foot patrolling...kung may mga naglalakad-lakad dyan na rumoronda na pulis, barangay, tanod, ayan ang pinaka-effective, sa tingin ko ha.”*

*“... pa-igtingin pa lalo ng barangay ng burol tong seguridad nila, kasi di ko sila napapansin masyado na nagpapatroly dito, lalo na sa umaga...”*

#### *Conduct of crime awareness seminars*

A participant suggested conducting crime awareness seminars for community residents. Additional knowledge by means of conducting seminars may benefit the public in terms of knowing how crimes are committed and methods to prevent being a victim of crime. The participants stated:

“... magkaroon ng proper seminar sa lahat ng area dun sa Burol Main, mas maganda pati sa mga schools na nasasakop sa Along Mangubat Avenue, para mas maging aware yung mga citizens doon...”

#### *Public cooperation*

Police-community cooperation was suggested by a respondent. In order to fully accomplish the purpose of deterring crime, public collaboration is required. Law enforcement's efforts together with the publics will succeed in supporting the police for the greater good. The participant stated:

*“Ang improvement na nakikita namin dyan is yung cooperation ng public sa personnel na dapat makinig sila sa sinasabi ng pulis natin na itago na yung mga valuable items, kasi kung wala naman mahahablot sa kanila o mananakaw, usually kasi nangyayari dyan sa Mangubat Avenue, agaw cellphone...kung tinatago ng mga estudyante yung cellphone nila na di nila ginagamit sa public walang mananakaw yung mga perpetrator...”*

#### *Additional CCTV surveillance cameras*

A participant also suggested the installation of CCTV cameras especially in “blind spots” within the community. CCTV surveillance cameras have been effectively known to prevent crime and produce a sense of safety for the public. Hence, additional CCTVs, especially in crime-prone areas, can produce a deterrent effect by encouraging perpetrators to think twice before they commit a crime.

*“... isang factor din ng problema namin is yung CCTV lalo na sa pag.. tinatawag nating back tracking, kung saan inaalam natin kung saan nagpunta yung mga gumawa ng krimen sa area, yung area na yun ay meron doong lugar na hindi pa nalalagyan ng CCTV or na iinstallan, yun dapat ma improve rin sana natin CCTV.”*

#### *Additional streetlights*

Another participant suggested adding streetlights in unlit areas. Streetlights play a crucial role in deterring crime; thus,

installing additional streetlights can provide public safety and security. Better lighting will deter offenders who benefit from the absence of the same.

*“... yung mga streetlights, kasi tulad ko dito nasa spot ako na medyo madilim pero sa bukana may mga ilaw, siguro dagdagan yung mga ilaw dito para at least magdalawang isip gumawa ng krimen yung mga tao kasi alam nila makikita sila.”*

## **DISCUSSION**

The majority of crimes committed along Academia Drive were crimes against property. With the lack of cooperation of the public in filing cases against perpetrators, the PNP had a low crime record. However, in Barangay Burol Main, records showed that from January 2022 to June 2023, theft and robbery were the common crimes committed along Academia Drive with 34.19% and 19.35%, respectively. Yigzaw et al. (2023) stated that physical factors like crowded places were a major factor that influenced the occurrence of property crimes, as perpetrators can easily blend in with the crowd and go unnoticed.

The PNP-Dasmarinas, Barangay Burol Main, and business establishments highly implemented crime prevention strategies. Survey and interview results of this study showed evidence that the PNP Dasmariñas and the Barangay Burol Main have performed their duties and responsibilities in maintaining peace and order along Academia Drive. The PNP-Dasmarinas highly implemented proactive measures such as police visibility, daytime and nighttime patrolling, and an information campaign. These strategies help prevent and reduce crime and mobilize resources (Weisburd et al., 2023). On the other hand, the barangay performs patrols to achieve barangay visibility and maintains coordination with the PNP regarding the security, particularly of the students. These measures implemented by the barangay attested to its commitment to providing services to the people within its jurisdiction and maintaining law and order within its boundaries (Figer, 2023). Meanwhile, the business establishments along Academia Drive had different crime prevention strategies depending on their businesses; the majority

of them had CCTV surveillance cameras as their main tool for crime prevention, while only a few had security services, particularly the deployment of security personnel or guards within their establishment. According to Aballe et al. (2022), CCTVs are a vital tool for preventing crime, especially crimes against property, and for public safety. It forms part of the Crime Prevention Through Environmental Design (CPTED), which according to Behl and Steverson (2021) reduces criminal behavior by strategically placing buildings using the concepts of “target hardening” and “defensible space,” which eliminates criminal opportunities in and around a property. The high implementation of CCTV surveillance cameras in business establishments attests to the need to maintain safety around the property.

Although the PNP-Dasmariñas, Barangay Burol Main, and business establishments have been implementing different crime prevention strategies, they have also encountered challenges along the way. The PNP Dasmariñas’ primary concern was the lack of personnel to be deployed along the Academia Drive and the absence of CCTV cameras. A similar problem was experienced by Barangay Burol Main: a lack of barangay tanods. Meanwhile, the majority of business establishments along Academia Drive experienced a lack of tools and materials relative to crime prevention. There was the installation of CCTV cameras, but some were of poor quality. Lastly, as the majority of business establishments are small businesses, the absence of security services was an obvious issue.

There are still improvements that need to be made. To further fight and deter crime along Academia Drive, the respondents suggested to augment additional police and barangay personnel to patrol the area, conduct crime awareness seminars for the public, promote public cooperation, install better CCTV cameras, and install streetlights in dark areas. These measures may be recognized as “capable guardians” from the Routine Activity Theory. It is hoped that these measures will contribute to the enhanced security and protection of the vulnerable population – the students – who traverse the Academia Drive.

## **Conclusion**

The government, represented by the PNP-Dasmarinas and Barangay Burol Main, highly implemented proactive measures to prevent crimes along the Academia Drive, the majority of which are crimes against property such as theft and robbery. Common among these organizations is the implementation of daytime and nighttime patrolling and coordination between these two entities to preserve peace and order in the area. However, findings of this study demonstrated the need for higher authorities and the city government to improve the manpower and resource requirements of both entities in order to keep up with their duties and responsibilities of enforcing laws and protecting the people, especially students who usually become victims while traversing the Academia Drive. The business establishments have likewise implemented their own strategies to deter crime from occurring within their business areas, such as the installation of CCTV cameras as their primary tool. However, their challenges also pointed out to the same requirements, that is, deployment of security personnel and upgrading of their crime prevention tools particularly CCTV to protect their businesses from crime. Because business establishments are private entities, educating business owners and employees on crime prevention measures, as well as allocating funds for crime prevention tools and materials are needed to help them in protecting their businesses, themselves, and their customers from potential criminal activity.

## **Recommendations**

The researchers proposed an integrated crime prevention program focused on the implementation of projects by virtue of Republic Act No. 11966, also known as the "Public-Private Partnership (PPP) Code of the Philippines." The projects include (1) providing resources to business establishments along the Academia Drive for them to acquire CCTV cameras following the guidelines of Provincial Order No. 2013-049, also known as the "CCTV Installation Ordinance of the Province of Cavite 2013," and (2) funding the Local Government Unit of Dasmarinas for providing trainings, seminars, and incentives to acquire volunteers to fill the human resources gap of the law enforcement group.

Moreover, this study also recommends the following to key entities:

**Business owners.** The researchers would like to recommend that the business establishments along the Academia Drive follow Provincial Order No. 2013-049, also known as the “CCTV Installation Ordinance of the Province of Cavite 2013,” on the following specifications that a CCTV must have: a) have one dedicated channel for each camera in operation; b) shall record at least 640 by 480 recording resolution level; c) shall have the capacity to record at fifteen frames per second, per camera; d) shall have enough memory to retain data from all cameras for a period of thirty (30) days; e) possess the ability to view and retrieve data while the system remains operation; f) possess the ability to produce DVD-R copy of desired data for evidence purposes on a format playable via Windows player to standard DVD player; g) possess the ability to time stamp and watermark the recorded images; h) shall be placed in a locked and secured location to prevent destruction of tampering; i) shall operate with a minimum of 180 Total Vertical Lens (TVL) of resolutions; j) shall have the ability to record color images during sufficient lighting and record in black and white during hours of low light; k) each camera shall be matched to each specific application taking into consideration the distance to target image, compatibility with the amount of light available to include excessive amounts of sunlight and view angle of camera in relation to the area of a desired coverage; l) each camera shall have clear and unobstructed view of the area of desired coverage; m) camera shall be positioned to capture “Head and Shoulder” images at exits, entrance, and points of locations.

**Barangay officials.** The researchers would like to recommend that the barangay officials of Barangay BuroI Main strengthen their implementation of their usual crime prevention strategy to further lessen the crime rate along Academia Drive, as theft and robbery highly occur. Additional personnel and volunteers are needed to fill in the lack of human resources; therefore, strengthening public-private partnerships is recommended.

**Local Government of Dasmariñas.** The researchers would like to recommend to the Local Government of Dasmariñas that they strengthen the public-private partnership to establish a long-term goal to further deter crime along Academia Drive, which involves funding equipment for crime prevention for businesses and providing a support service. It is also suggested that they consider regularly assessing the effectiveness of crime prevention

programs and initiatives within Academia Drive to adapt new strategies based on evolving crime trends and community needs.

**Dasmariñas City Police Station.** The researchers would like to recommend that the PNP-Dasmariñas have additional personnel that could be deployed along Academia Drive. Despite the fact that the patrol is highly implemented, crime still persists. This might require changes in the type of patrol used; therefore, intensifying the implementation of foot patrolling in crime-prone areas is highly suggested, strengthening coordination within business establishments, and providing a new strategy to further lessen the high crime rate of theft and robbery along the area.

**Future researchers.** This study can be used as a basis for future researchers studying the same research. Future researchers can consider other related places to conduct their own study. Adding the perceptions of the community to the efforts of law enforcement to determine the effectiveness of their crime prevention strategies is also recommended.

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# **Development of Real-Time Object Recognition with Text-To-Speech Features: An Android-Based Application for Visually Impaired Users.**

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## **KEYWORDS:**

- **Android Application**
- **Visually impaired users**
- **Optometrists**
- **Real-time**
- **Object recognition**
- **Text-to-speech**
- **Color correction**
- **ISO 25010**
- **Cronbach's Alpha**

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**Abstract.** This developmental research aims to alleviate the effects of visual impairment and improve the quality of life for visually impaired students through an Android application. The application enables users to select objects or texts from their phone's camera feed and provides auditory feedback through text-to-speech on these items. It also offers a color correction feature, enhancing the overall user experience. The research encourages visually impaired individuals to utilize object recognition, text-to-speech, and color correction features to

participate in a wider range of activities that their vision once hindered. The application fosters a culture of inclusivity, diversity, and equal opportunities by seamlessly integrating into the daily lives of its users. This study was supervised by optometrists to ensure that the functionalities of the system would be beneficial to the target users. Purposive sampling was used for the data gathering procedure, ISO 25010 for the conceptualization of the entire thesis, especially on the standards abided by the Android system, and Cronbach's alpha, which was used as a test for the reliability of the survey questionnaire, were all used in the methods. The application has proven successful, with high user satisfaction scores and positive feedback, promoting holistic engagement for all, regardless of their backgrounds, abilities, or identities. The application not only increases educational opportunities but also empowers visually impaired individuals to learn, grow, and interact with the world.

# **Development of Real-Time Object Recognition with Text-To-Speech Features: An Android-Based Application for Visually Impaired Users.**

## **INTRODUCTION**

Visual impairment is a prevalent and life-altering condition, imposing significant challenges on everyday life. It hinders fundamental activities such as reading and recognizing objects. There are an estimated 2.2 billion visually impaired individuals worldwide (World Health Organization, 2019). These challenges are not merely inconveniences but profound barriers to accessing information, education, employment, and social inclusion. In response to these challenges, this thesis embarks on a visionary journey, presenting a groundbreaking endeavor in the form of an Android application that was meticulously designed to address the unique needs of visually impaired individuals. By seamlessly integrating real-time object recognition, text-to-speech conversion, and color correction capabilities within a user-friendly interface, the application is aimed at providing the visually impaired with a versatile and indispensable tool. An Android tool that aims to empower them to effortlessly access printed text, navigate surroundings, and identify objects of importance, thereby augmenting their accessibility and fostering inclusivity. It endeavors to demonstrate not only the technical feasibility but also the real-world impact of such innovations. This thesis aspires to be a catalyst for change, sparking conversations, inspiring further research, and ultimately paving the way for a more inclusive and accessible future for the visually impaired community. It is our collective responsibility to harness the potential of technology to bridge the divide, empower individuals, promote equality, and this study is testament to that commitment.

## METHODOLOGY

### RESEARCH DESIGN

Qualitative research is needed for this kind of study because it involves with the collection and analyzation of non-numerical data such as text, video, or audio to be able to understand such concepts, opinions, and experiences regarding visually impaired individuals and how it can be also used to gather in-depth insights with regards to how people with visual impairments cope with their limited vision which can create new ideas for researchers such as this study (Bhandari, 2020).

The Android application will be made following the Agile Methodology to enable iterative development, fast feedback cycles, and adaptability to efficiently curate an Android application to meet the evolving needs, designs, and other specifications of the visually impaired students as it is a management approach that segregates the project into smaller and manageable sections and focuses more on continuous collaboration and development of the system. It follows the planning, execution, and evaluation cycle (Atlassian, 2023). The design and user interface will be user-friendly based on the Optometrists' guidelines.



*Diagram 1. Illustration of Agile Methodology*

This research employs a Descriptive Developmental research method to gather real facts about the status and provide a framework for describing, comparing, analyzing, and interpreting the existing data. It is beneficial in this case as it allows the researchers to understand the needs of visually impaired students and curate an application with a deep understanding of the user's needs and experiences

## **RESEARCH LOCALE**

The research was conducted at Emilio Aguinaldo College - Cavite, located at Congressional Avenue, Barangay Burol Main, City of Dasmarinas, Cavite, Philippines. EACC is a private non-sectarian academic institution that has a wide selection of degree programs. The participants are 64 clinically regarded as Visually Impaired students within the Emilio Aguinaldo College Cavite campus. The researchers determined the sample size organically by conducting a pre-survey assessment to EACC students ensuring accurate data for their research with the right characteristics of the respondents. This study was conducted from August 2023 to May of 2024. The system testing and data gathering spanned from February to April 2024.

## **SAMPLING TECHNIQUE**

The proponents used a purposive sampling technique. In this case, the selection of participants will be limited to visually impaired individuals. This method ensures that the sample is specifically relevant to the research question, providing more reliable and applicable results. Any student who falls under what the optometrists regard as a part of the category of visually impaired individuals and is available during the data gathering will be a participant in the study.

## **DATA GATHERING PROCEDURE**

The proponents initiated the data gathering process by sending a consent letter outlining the purpose of the study, the procedures involved, and the potential benefits and risks. It also assured the participants of their rights, including the right to withdraw from the study at any time without penalty. All personal information collected from the participants will be kept confidential.

The survey questions were designed to be clear, concise, and relevant. They were validated by the thesis adviser and developed with optometrists' supervision to ensure they effectively gathered the necessary data. Optometrists also received an interview form with detailed questions about the study, which aided in writing of the research paper and the sampling, development, and testing of the system.



After using the program, the respondents completed a structural questionnaire that addressed the study's problem statement. During this phase, if any problems or errors were discovered, the researchers returned to the program coding step to resolve the errors. This iterative process ensured the developed system was robust and met the study's objectives and the needs of the visually impaired users.

The evaluation of the developed system was deemed complete once the system functioned as intended. This marked the end of the data gathering process and the beginning of the data analysis phase. The data collected from the questionnaires were then analyzed to draw conclusions and make recommendations for future research. The project evaluation in its efficacy and performance was tested in compliance to the ISO/IEC 25010 Software Quality Standard along with the testing of Cronbach's alpha values to indicate that response values for each participant across a set of questions are consistent, thereby strengthening the integrity and reliability of this study's findings.

### **DATA ANALYSIS (Statistical Tool and Treatment of Data)**

In data analysis, the proponents used Likert scale for the questionnaire adhering to ISO/IEC 25010 Software Quality Standards. It helps to see if the system will become an effective aid for visually impaired students. It contains a set of questions, and the respondents will select the one that corresponds best to the way they deem or rate the performance and effectiveness of the product or system, on a scale of 1-4. The data analysis conducted for this study involves both descriptive and inferential statistics.

For the descriptive statistics, the mean will be calculated for each questionnaire item. This will provide a summary of the responses from the visually impaired students on the usability and effectiveness of the Android application. And to analyze if there is overall reliability in the questionnaire items, Cronbach's alpha will be computed. Cronbach's alpha is a measure used to assess the internal consistency of a set of scale or index items.

## **RESEARCH INSTRUMENT(S)**

### **Interview Question for Optometrists**

The Interview Form Questions used are the following:

1. What are considered to be visual impairments? Is mild blurriness and/or astigmatism already considered visually impaired?
2. What are some commonly known visual impairments that affect students, and do you happen to know how they impact their educational experience?
3. What are the key challenges faced by visually-impaired students in accessing educational materials and information in real-time?
4. Is it possible for a mobile application incorporating real-time object recognition with text-to-speech and color correction technologies to assist visually-impaired students in their daily lives and educational pursuits?
5. Are there any specific considerations or adaptations needed to ensure the application is accessible to a wide range of visually-impaired students with varying needs?
6. How can the application be customized to address the specific requirements of visually-impaired students in different educational settings (e.g., primary school, high school, college)?
7. Are there any ethical or privacy concerns related to using a mobile application that incorporates real-time object recognition with text-to-speech and color correction technologies for visually-impaired students?
8. What are the potential challenges in integrating the application with existing educational platforms and tools used by visually-impaired students?
9. In your opinion, what are the key factors to consider when designing and developing a mobile application specifically tailored for visually-impaired students?
10. As an Optometrist, do you think that the development of this system will be beneficial? If so, may you enumerate some benefits you think it would have for the visually impaired?

## **Survey Questionnaire**

The Pre-Assessment Survey Questions are the following:

1. Name (Surname, First Name Middle Initial) \*optional
  - Short Answer Text
2. Do you have a visual acuity of 20/40 or worse?  
(If your answer is "No", you are not eligible for this study.)
  - Yes
  - No
3. What type of visual impairment do you have?
  - Astigmatism
  - Nearsightedness
  - Farsightedness
  - Low vision (20/70 - 20/200)
  - Color blindness
  - Other (please specify)
4. If you are color blind, What type of color blindness do you have?
  - Red-Green color deficiency (Deuteranomaly) - have a reduced sensitivity to green light and may struggle to distinguish between red and green hues.
  - Red-Green color deficiency (Protanomaly) - have altered red perception where reds may appear muted or shifted.
  - Blue-Yellow color deficiency (Tritanomaly) - difficulty distinguishing blue and green where blues may appear desaturated or grayish.
5. Do you have prescription glasses or contact lenses?
  - Yes, I have prescription glasses
  - Yes, I have contact lenses
  - Yes, I have both
  - No, I don't have prescription eyewear
- 5.1 (for those who answered "No, I don't have prescription eyewear")  
If you are visually impaired but don't own eyeglasses or contact lenses, why don't you wear prescription eyewear?
  - Short Answer Text

6. For how long have you been diagnosed with visual impairment/s?
  - Less than 1 year
  - 1-5 years
  - 5-10 years
  - More than 10 years
7. Course or Strand (ex. BS Computer Science/STEM) for this study.)
  - Short Answer Text

The Main Survey Questions used with Likert Scale are the following:

1. The text-to-speech feature accurately reads text aloud, and the voice used speaks clearly and naturally, and allows easy access to printed textbooks and materials.
2. The object recognition feature clearly identifies objects, assisting in interactions with peers and professors, as well as class participation.
3. The color correction feature effectively alters the entire application's color scheme, allowing me to perceive a wider range of colors while also navigating my surroundings.
4. The interface and features of the application are accessible, which helps increase productivity and enables participation in a wider range of academic activities.
5. The application coexists with other Android applications without causing conflicts or performance issues, and it works seamlessly and adapts to changes across different Android devices
6. The application provides clear instructions and intuitive guidance for easy learning which promotes independence and confidence in studying using an Android device.
7. The application provides equal opportunities for class participation, similar to sighted students.
8. I feel confident that my interactions within the app are secure as it ensures data privacy and prevents unauthorized access.
9. Overall, the Android application is a useful tool to ease the effects of visual handicap on learning with or without the use of prescription eyewear.
10. The system aligns with the needs of the visually impaired, and I would recommend it to other visually impaired

students.

## PROJECT AND ITS STRUCTURE

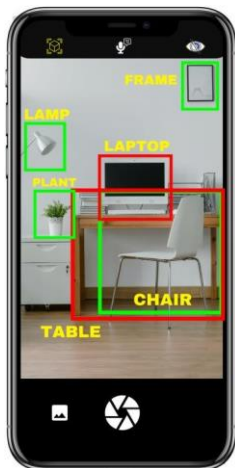


Diagram 2.1: Object Recognition feature

As seen on diagram 2.1, after verification the users are able to use their cellphones camera with three buttons on top of the screen. These three buttons are OCR – Object Recognition, TTS – Text-to-Speech, and CC – Color correction. The object recognition works by tapping the OCR button which is the top left icon then pointing the phone's camera directly to the object the user wants to identify and take a picture of it, there are colored red and green bound boxes once the picture has been taken, the red bound box is when there are multiple objects in the frame that the user does not want to identify, they can tap the object they want to identify which turns the bound box green to make the application have a clearer understanding on what object the user wants to identify. With the assistance of the object recognition feature the user can get an idea of what kind of object/s is in front of the camera.



Diagram 2.2: Text to Speech feature

In Diagram 2.2 it is shown that if there is visible text in said object the user can tap the TTS button on the top middle to be able to identify and vocalize said text. It functions the same way as the OCR but with text instead of objects, and once the picture has been taken the text should be highlighted so that the user further understands what is in front of them.



Diagram 2.3: Color Correction feature

There is also a color correction feature by tapping the CC button on the top right which allows the user to toggle different kinds of color-blind friendly tones: Deuteranomaly, Protanomaly, and Tritanomaly that can be implemented in the application for better user experience and enhanced quality.

RESULTS

Table 1

*Likert table for qualitative interpretation used in interpreting the results of the survey*

Scale	Range (Intervals of 0.75)	Qualitative Interpretation
1	1.00 – 1.75	Poor
2	1.76 – 2.50	Fair
3	2.51 – 3.25	Good
4	3.26 – 4.00	Excellent

Table 1 shows the Likert scale used to rank or measure the feedback of the respondents for the system, which will then be used to convert the mean score into verbal representation. The proponents intended the use of the Likert scale to interpret the

result and the overall ISO/IEC 25010 evaluation average. Table 1 displays a scale from 1 to 4, each with a corresponding interval range of 0.75. The range per scale is what ultimately determines what qualitative interpretation the mean score falls under.

Continuing this, the next table, Table 2 highlights the quality characteristics, the sub-characteristics and its corresponding sub-questions, the mean of the sub-questions obtained from its corresponding parent survey question. Additionally, it presents the overall mean average per ISO 25010 quality characteristics along with the corresponding verbal interpretation per part. This table helps us understand the quality characteristics in a more detailed and comprehensive manner, as the system's success or failure is determined by the Overall Weighted Average based on the ISO 25010 standard.

Table 2

*Mean Calculations for Sub-Questions and Sub-Characteristics, and Verbal Interpretations of the Quality Characteristics of the ISO/IEC 25010 Standard*

Quality Characteristics	Sub-characteristics	Sub-question	Mean	Verbal Interpretation
Functional Suitability	Correctness	Does the text-to-speech feature accurately read text aloud?	3.9065	Excellent
		Does the object recognition feature clearly identify objects?	3.765625	Excellent
	Appropriateness	Does the color correction feature allow you to perceive a	3.796875	Excellent

		wider range of colors while navigating your surroundings ?		
		Is the Android application a useful tool to ease the effects of visual handicap on learning?	3.875	Excellent
		Does the system align with the needs of the visually impaired?	3.9375	Excellent
Overall Functional Suitability Mean			3.8563	Excellent
Usability	Understand ability	Does the voice used in the text-to-speech feature speak clearly and naturally?	3.9065	Excellent
	Operability	Does the text-to-speech feature allow easy access to printed textbooks and materials?	3.9065	Excellent
		Does the color correction feature effectively alter the application's color scheme?	3.796875	Excellent
		Are the interface and features of the	3.90625	Excellent



		application accessible?		
		Do the interface and features of the application help increase productivity and enable participation in a wider range of academic activities?	3.90625	Excellent
	Learnability	Does the application provide clear instructions and intuitive guidance for easy learning?	3.828125	Excellent
<b>Overall Usability Mean</b>			<b>3.875083 333</b>	<b>Excellent</b>
Reliability	Maturity	Does the object recognition feature assist in interactions with peers and professors, as well as class participation?	3.765625	Excellent
	Availability	Does the application provide equal opportunities for class participation, similar to sighted students?	3.921875	Excellent
<b>Overall Reliability Mean</b>			<b>3.84375</b>	<b>Excellent</b>
Compatibility	Co-existence	Does the application coexist with other Android	3.84375	Excellent

		applications without causing conflicts or performance issues?		
	Interoperability	Does the application work seamlessly and adapt to changes across different Android devices and screen sizes without issues?	3.84375	Excellent
<b>Overall Compatibility</b>			<b>3.84375</b>	<b>Excellent</b>
Security	Confidentiality	Does the application ensure data privacy and prevent unauthorized access?	3.875	Excellent
	Integrity	Do you feel confident that your interactions within the app are secure?	3.875	Excellent
<b>Overall Security Mean</b>			<b>3.875</b>	<b>Excellent</b>
Portability	Adaptability	Can the application be used with or without the use of prescription eyewear?	3.875	Excellent
<b>Overall Portability Mean</b>			<b>3.875</b>	<b>Excellent</b>
<b>TOTAL WEIGHTED MEAN</b>			<b>3.86148 0556</b>	<b>Excellent</b>

Table 3.1 shows the verbal interpretation of the mean of all user responses after it was ranked using the Likert table for qualitative interpretation making it easier to interpret. According to Table 3.1, the researchers have observed that the android

application is regarded as a useful tool for visually impaired students, with its overall weighted average of 3.86, the overall object recognition, text to speech, and color correction features are rated as “Excellent” in terms of quality characteristics; deeming the system widely approved of by the respondents of this study.

Table 3

*Mean Calculations for Sub-Questions and Sub-Characteristics, and Verbal Interpretations of the Quality Characteristics of the ISO/IEC 25010 Standard*

ANOVA						
Source of Variation	Sum of Squares	Degrees of Freedom	Mean Sum of Squares	F-statistic	P-value	F critical value
	SS	df	MS	F	P-value	F crit
Rows	40.24		0.638789	8.1609	1.2299	1.5001
Columns	375	63	683	63245	E-47	4126
	1.818		0.202083	2.5817	0.0063	2.4386
	75	9	333	49049	96699	4861
Error	44.38		0.078273			
	125	567	81			
Total	86.44					
	375	639				
<b>Cronbach's Alpha</b>	0.877					
	4654					
	4					

Having observed the result of Cronbach's Alpha computation, and computing it through Two Factor Anova, this scale provided below is a commonly used interpretation of Cronbach's Alpha values:

- Excellent ( $\alpha \geq 0.9$ ): The items have very high internal consistency.
- Good ( $0.9 > \alpha \geq 0.8$ ): The items have high internal consistency.
- Acceptable ( $0.8 > \alpha \geq 0.7$ ): The items have acceptable internal consistency.

- Questionable ( $0.7 > \alpha \geq 0.6$ ): The internal consistency of the items is low and may be considered questionable.
- Poor ( $0.6 > \alpha \geq 0.5$ ): The internal consistency of the items is poor.
- Unacceptable ( $\alpha < 0.5$ ): The internal consistency of the items is unacceptable.

This scale helps researchers to understand the reliability of their instrument and whether it's measuring the intended construct consistently. Considering that the result of the statistical computations resulted in an internal consistency of 0.88 falling under the category of "Good", implying that the items in the test have good consistency, meaning the items are well correlated and therefore accepted.

## **DISCUSSION**

Overall, the system based on received positive feedback from users, indicating high reliability and performance. Based on the evaluation using Cronbach's Alpha, the system received an acceptability rating of 0.88, indicating that it is interpreted under the category of "Good." On the other hand, users rated the system's overall effectiveness based on the ISO/IEC 25010 Software Quality Standard usability criteria, a mean score of 3.86 out of a perfect 4.0, thus falling under the "Excellent." The visually impaired users found the real-time object recognition, text-to-speech, and color correction features valuable for enhancing accessibility for the visually impaired.

The research paper's findings hold significance for the visually impaired community. By providing real-time assistance with object recognition, text-to-speech, and color correction, the app contributes to improving their daily lives by ensuring accurate interpretation of visual information.

## **CONCLUSION**

From the summary of findings, the researchers' conclusions for this study are:

1. The application enables users to select objects and/or texts from their phone's camera feed. It provides them with auditory feedback on their chosen items and offers a color

- correction feature, thereby enhancing the overall user experience.
2. Encouraged the visually impaired to participate in a wider range of activities, ones that were once hindered by their vision, and increase their educational opportunities and experiences.
  3. To have fostered a culture of inclusivity, diversity, and equal opportunities, promoting holistic engagement for all, regardless of their backgrounds, abilities, or identities with the use of the Android application.

## **RECOMMENDATIONS**

Based on the conclusions, future researchers should consider these factors related to the study and should further continue improving this research by:

1. Allowing users to add items to the OCR dataset by capturing a video of objects that the app has not yet recognized. Users can then send these videos as requests for evaluation. Once verified by the developers, the objects will be added to the dataset.
2. Adding an Invert Color Space feature that reveals to people with normal vision what color-blind individuals see and how it affects their daily life in identifying colors. This feature will be added as an educational tool to help us better understand how we perceive the world through the lens of another.
3. Implementing IOS support for the application. So that visually impaired apple phone users can use the application as well. Inclusion of the support for IOS OS can help broaden the scope of users that are able to use the application and include the IOS users gain opportunities to academic affairs.
4. Improving the real-time object recognition. So that the application can increase its efficiency and effectiveness. To reduce time constraints and improve the overall application.
5. Creating quick touch-oriented controls to lessen complications while using the application. So that users who are having a hard time navigating the system can be able to adapt from the application quickly.
6. Include a voice assistant to aid individuals with severe visual impairments who could have a difficult time setting up or navigating the Android application.

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# **Effectiveness Of Dry-Toothbrushing On Salivary Fluoride Concentration To Maintain Normal Ph Range Among 10-11 Year-Old Pupils In A School In Dasmarinas City, Cavite**

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## **KEYWORDS:**

- **Dental caries**
- **Fluoride concentration**
- **Dry-toothbrushing**
- **Wet-toothbrushing**
- **Salivary pH level**

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**Abstract.** Dental caries is one of the most prevalent dental conditions that occur worldwide in any age group. According to the latest report released on March 25, 2020 by the World Health Organization (WHO), an approximate number of 2.3 billion people suffer from dental caries of the permanent teeth while there are more than 530 million children suffer from caries of primary teeth. This

problem is counteracted by preventive solutions such oral health education and proper toothbrushing. The study aims to progressively understand the relationship of using “Dry-toothbrushing” as a way of maintaining normal salivary pH level by the increased fluoride concentration in the saliva of children in mixed dentition stage (6-12 years old) as compared to the traditional “Wet-toothbrushing” method. Experimental research is utilized to determine the significant effect of the different toothbrushing rinsing methods on the salivary pH level among Grade 5 students (10-11 years old) of New Era Elementary School, from which the students are purposively selected based on the several factors of inclusion criteria of the study. The pre-test and post-test test results of salivary pH level obtained from the participants are used to justify the results taken. Data were analyzed blindly by the statistician using the ANOVA technique. Based on the results of the study, there is a substantial increase in salivary pH after brushing without rinsing with water. It is therefore concluded that Dry- toothbrushing is the most effective way of maintaining the normal salivary pH in the oral cavity as compared to the traditional wet toothbrushing.

# **Effectiveness Of Dry-Toothbrushing On Salivary Fluoride Concentration To Maintain Normal Ph Range Among 10-11 Year-Old Pupils In A School In Dasmarinas City, Cavite**

## **INTRODUCTION**

One of the most common dental conditions occurring worldwide in any age group, is dental caries. According to the latest report released on March 25, 2020 by the World Health Organization (WHO), around 2.3 billion adult individuals have dental caries on their permanent dentition while an estimated amount of over 530 million children has caries in their early age. With this posing problem occurring throughout the years, several programs by the local government were passed and conducted to the community to somehow aid the condition. One of the foci of the program is to promote tooth brushing. This practice makes the teeth less susceptible to caries attack since it mechanically removes particle and microorganism present in the oral cavity. Additionally, using toothpaste that contains fluoride encourages the release of fluoride into the mouth, making it available to change hydroxyapatite into fluorapatite.. Moreover, there are several studies in the present time that educates people on how to properly maximize the beneficial effect of fluoridated toothpaste in the teeth.

According to the report of the Philippine Pediatric Dental Society, Inc. (PPDSI), spitting out extra toothpaste after brushing your teeth is the recommended method of post-tooth brushing, hence, no water rinsing is better, opposite to the traditional rinsing with water method known to our country. This traditional method washes away the remaining fluoride in the mouth, reducing its levels to suboptimal conditions. When the water reduces the fluoride concentration inside the oral cavity, the recommended optimal fluoride amount for each age group would not be met.

This gap in the difference of post-brushing method done traditionally in our country versus the suggested no rinsing method by the PPDSI increases the salivary fluoride concentration which can have significant effect on maintaining the pH level of the oral cavity, and are directly proportional to the pervasiveness of dental caries in the chosen population.

## **METHODOLOGY**

The study used a quantitative approach. According to Aliaga and Gunderson (2002), quantitative research explains occurrences of a social problem by collecting numerical data that is analyzed using mathematically based methods, particularly statistics. The problem or phenomenon that the researchers would like to address is the gap in the interrelation of salivary fluoride concentration in the Wet brushing method and the optimal fluoride concentration that must be retained inside the oral cavity. Thus, this study aimed to test if high fluoride in "Dry-toothbrushing" can increase salivary pH level of the children in mixed dentition stage (6-12 years old) specifically among grade 5 students aged from 10-11 years old (n=30), as compared to the traditional "Wet-toothbrushing" that should possibly fill the gap that is occurring in the present time. An experimental Research Design was also used.

Experimental research intends to determine the significant effect of the effectiveness of using "Dry- toothbrushing" as a way of enhancing the fluoride concentration in the saliva to maintain normal oral pH level.

Likewise, using the manipulation of at least one independent variable, control of the other independent variables, and observation of the influence on one or more independent variables is how Dr. William Allan Kritsonis (n.d.) defines experimental research design. The pre-test and post-test results of the salivary fluoride concentration obtained from the participants' pre-tests and post-tests were used in this study's experimental design.

The experimental method needs a total of thirty (30) participants which were divided into two groups. 15 participants among the group had expectorated toothpaste without rinsing

(dry), while the controlled method, requiring another 15 participants among the group had rinsed with 100 ml of water after brushing. This design will help the researchers to test the hypothesis of identifying the pH level in the saliva after using the dry toothbrushing (experimental) and wet toothbrushing (control) methods. According to Martin Shuttleworth (2009), pretest-posttest designs are the recommended strategy for comparing participant groups and measuring the degree of change caused by treatments or interventions in many real experimental designs. Furthermore, pretestpost-test are known to establish an internal validity among research. This test allows for a variety of analysis, including the ability to filter out experimental noise and confounding variables. This approach has high internal validity because the pretest guarantees that the groups are equivalent.

The experimental group is given the therapy, and both groups are examined afterward to see how changing the independent variable affects the dependent variable. This method is preferred in order to successfully compare the participant group mean scores and determine the extent of change once treatments and interventions have been implemented.

### ***Ethical Consideration***

The study had undergone review by the members of Emilio Aguinaldo College-Cavite Ethics Review Committee and is granted with Ethics Review Certification (EACC ERC Code: 2023-01-004), for approval, which hereby declares that the study having bound free from ethical issues and violation set forth by the EACC Ethics Review Committee.

## RESULTS

Table 1

*Statistical Analysis on the Pre-Test salivary pH level of the Controlled (Wet toothbrushing) and Experimental (Dry toothbrushing) group*

	Group	Week	n	M	SD
Pre-test	Controlled (Wet toothbrushing)	1	15	7.01	0.33
		2	15	6.8	0.57
	Experimental (Dry toothbrushing)	1	15	6.91	0.54
		2	15	6.75	0.32

Table 2

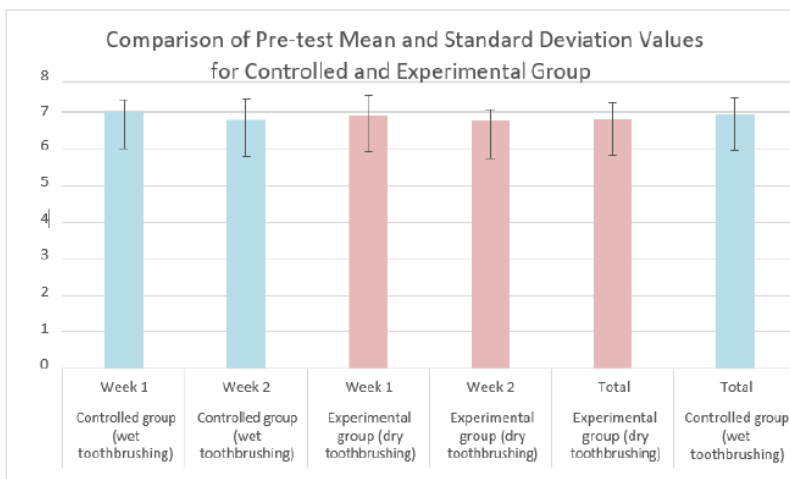
*Statistical Analysis on the Post-Test salivary pH level of the Controlled (Wet toothbrushing) and Experimental (Dry toothbrushing) group*

	Group	Week	n	M	SD
Post-test	Controlled (Wet toothbrushing)	1	15	7.29	0.51
		2	15	6.97	0.62
	Experimental (Dry toothbrushing)	1	15	7.49	0.61
		2	15	7.16	0.36

Table 1 and 2 display the mean saliva pH level grouped between the different sessions (i.e., pre-test and posttest), group (i.e., controlled: wet toothbrushing and experimental: dry toothbrushing), and time periods (week 1 and week 2). In week 1, 15 participants from each group (control and experimental) were taken with pre- and post-salivary pH level. In week 2, cross-over technique was done where the 15 participants from control group in week 1 were switched to become the experimental group in week 2. The result shows that the saliva pH level behaved in a similar fashion in both groups (wet toothbrushing and dry toothbrushing) during pre-test. However, it may be seen that the saliva pH level was relatively high during the post-test, ranging from M=6.97 (SD=0.62) to M=7.49 (SD=0.61), indicating that the

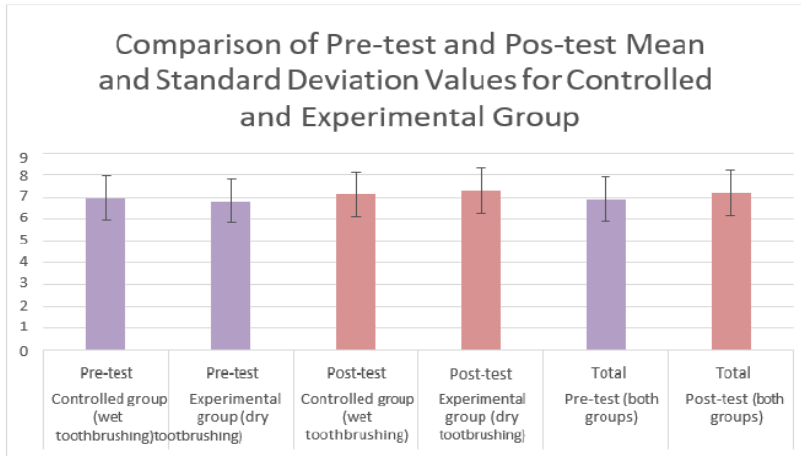


saliva pH level is more acidic among the participants during the pre-test.



*Figure 1. Comparison of Pre-test for Controlled (Wet toothbrushing) and Experimental Group (Dry toothbrushing).*

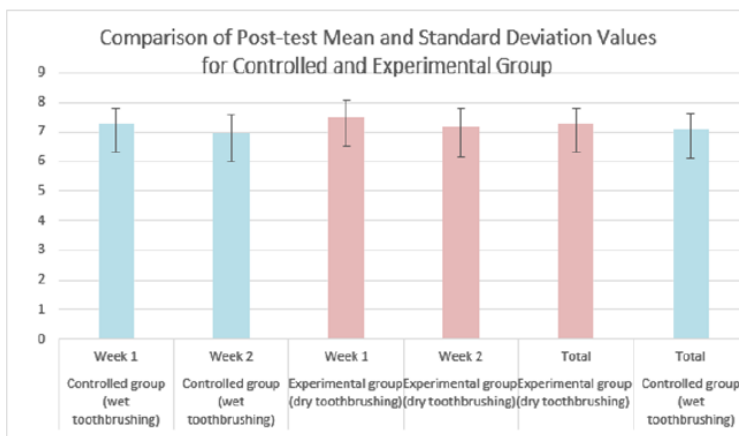
Figure 1 displays the pre-test salivary pH mean levels of the control group (wet toothbrushing) with  $M= 6.95 \pm 0.45$ ; while the experimental group has  $M=6.83 \pm 0.43$ . This suggests that there is no significant difference between the salivary pH level pre-tests from both groups. The salivary pH level from the control and experimental groups became more acidic when sugar was introduced among the participants before the pre-test data extraction.



*Figure 2. Comparison of Pre-test and Post-Test for Controlled (Wet toothbrushing) and Experimental Group (Dry toothbrushing).*

Figure 2 compares the pre-test salivary pH mean levels of both group (wet and dry toothbrushing) with  $M= 6.9 \pm 0.44$  with the post-test pH mean level of both group (wet and dry toothbrushing) which has  $M=7.2 \pm 0.52$ . This indicates that salivary pH level in post-test after toothbrushing with wet and dry method produces a larger mean value as compared to pre-test. Toothbrushing, regardless of the method used increases the salivary pH value.

*Effectiveness Of Dry-Toothbrushing On Salivary Fluoride Concentration To Maintain Normal Ph Range Among 10-11 Year-Old Pupils In A School In Dasmarinas City, Cavite*



*Figure 3. Comparison of Post-test Mean and Standard Deviation Values for Controlled and Experimental Group*

The graph shows the difference of mean change of the saliva pH level of the control group (wet toothbrushing) and the experimental group (dry toothbrushing) during post- test. The control group yielded a  $M= 7.1 \pm 0.55$  while the experimental group yields a  $M= 7.3 \pm 0.48$ . Consistent from the previous table, the result reveals a lower mean change of the saliva pH level under the controlled group compared to the experimental group.

Table 3

*Post-hoc Analysis on the Effects of Groupings on the Saliva pH Level*

Group 1	Group 2	t	p
Controlled	Experimental	-2.38	0.024*

On table 3, a post-hoc analysis has been carried out since the ANOVA findings show significant impacts of groupings on the mean change in saliva pH level. The t value (-2.38) validates the significant difference between the controlled and experimental group because t value of  $\pm 2$  indicates that there is a significant difference between groups while the p value (0.024) rejects the null hypothesis of the study which is "There is no significant difference between the post-test mean pH level of the saliva of controlled and experimental group." because p value that is lower than 0.05 rejects the null hypothesis. This indicates that the alternative hypothesis "There is a significant difference between the post-test mean pH level of the saliva of controlled and experimental group." is accepted.

## DISCUSSION

Saliva contributes to pH maintenance through two distinct mechanisms. It first eliminates acids made by bacteria and washes away carbohydrates that could be digested by bacteria. Second, saliva's buffering properties help to neutralize acidity from foods, drinks, and bacterial activity. With the second beneficial effect of the saliva presented above, the researchers think that determining the best way to attain the required salivary pH level in the oral cavity will be a great a way in controlling the prevalence rate of caries in the community, especially in children.

In the previous literatures discussed above, the role of sugar in lowering the salivary pH level has already been discussed. The result yielded from Table 2 and figure 3 supports this claim as the mean salivary pH level in pre-testing after being introduced with a

gum, produces a lower value regardless of the group they belong. According to Hans (2016), salivary pH reduced for all beverages shortly after consumption, whereas salivary flow rate increased. This lowering of pH occurs when the bacteria normally present in the oral environment interact with the carbohydrates being chewed while eating sugary foods. The saliva responsible in breaking down food in the first phase of digestion is filled with naturally occurring bacteria and these produce acid upon metabolism. The acid produced as a by-product by these organisms lowers the pH level of saliva making the oral environment more acidic. If this low value of pH level is not reversed back in its normal value ranging from 6.5 to 7.2, this could pose potential problems such as dental caries and dental erosion.

However, even though the pre-test means values in both groups show a low salivary pH value as compared to the post-test mean that it can still be inferred that the Grade 5 participants chosen in this study generally have healthy oral status as they produce a mean level of 6.9 pH, which is still within the normal pH range of 6.5 to 7.2. Thus, it is important that these children can maintain this condition as this will be an essential factor with their oral health in the future. Children in mixed dentition stage are the number one target in the application of preventive dentistry for some of their primary teeth have exfoliated and some of their permanent teeth start to erupt. Sufficient fluoride levels in saliva of children, which has a direct effect in pH level, can reduce caries incidence and prevent demineralization, while promoting remineralization of the tooth especially in children with high risk of caries. Thus, the most effective way introducing fluoride in the mouth is by toothbrushing using a fluoride toothpaste.

Toothbrushing is considered as one of the most effective and easiest way to maintain a healthy oral environment among individuals. With the results presented in Table 2 and Figure 3, it shows that the salivary pH level in post-testing after toothbrushing with wet and dry method produced a larger mean value as compared to pre-testing. It can therefore be inferred that using fluoridated toothpaste by means of toothbrushing, can increase available fluoride concentration, which has a direct relation with regards to salivary pH level. According Chatelier (2023), a pH ranging from 5.5 to 7.0 must be maintained in order for the saliva to have an effective buffering capacity. Thus, consistency in

toothbrushing is an essential way of balancing the pH level inside the mouth. As mentioned above, the dropping of pH to 5.5 can cause detrimental effects to the tooth as it may erode the tooth enamel progressively. However, if high amount of fluoride is present in the minerals that the saliva contains, it can attach to the hydroxyapatite crystals on the tooth and turn it into fluorhydroxyapatite (FHAP), which makes the tooth more resistant to erosion. As a result, when the pH falls below 5.5 (the critical point) and HAP is dissolved, FHAP precipitates at the surface of the crystals, and this process repeats when the pH increases again. Simply explained, low levels of fluoride, as low as 0.01-0.1ppm in the plaque/saliva interface, minimize mineral loss because FHAP is generated not only when HAP is dissolved, but also when HAP precipitates (when the pH increases again). Because of the precipitation or re-mineralization of both HAP and FHAP, the outer portion of the lesion is more mineralized than the area directly beneath the surface. Maintaining this balance inside the oral cavity is an important factor in controlling the prevalence rate of caries among the population. With the report released by NIH (2022), children over 7 and adults should brush at least twice daily with a toothpaste containing 1,350-1,500ppm fluoride. As a result of the topical application of fluoride, local calcium fluoride reservoirs are created, which promotes small amounts of fluoride that will be present in the plaque/enamel interface and minimizes mineral loss and facilitates remineralization.

Figure 4 shows that the mean change of the saliva pH of control group (wet toothbrushing) is lower than that of the experimental group (dry toothbrushing). This indicates that the dry toothbrushing method is more effective in increasing fluoride concentration in saliva which has a direct effect in increasing the salivary pH level. According to the report of the Philippine Pediatric Dental Society, Inc. (PPDSI), the proper method of rinsing the toothpaste after toothbrushing is spitting out the excess toothpaste and no water rinsing is the preferable way of post-toothbrushing method, opposite to the traditional rinsing with water method known to our country, because thorough rinsing reduces the fluoride in the mouth to sub-optimal level. However, Filipinos are not aware of this method and those who are aware still chose to rinse their teeth with water after brushing. Rinsing with water after brushing will wash out the fluoridated toothpaste and optimal amount of fluoride in the saliva would not be met. Fluoride is an essential factor in decreasing the solubility of the teeth therefore, when the water flushes the amount of fluoride

needed, the teeth become less protected from dental caries. The Department of Health (2012), reveals that above 90% of Filipinos are suffering from dental caries throughout the years, starting from the records of year 1998. Even when there are many oral health programs provided by the government, there is still a gap. The prevalence rate of dental caries is still high. The practice of dry toothbrushing method can fill this gap to lessen the prevalence rate of dental caries.

The focus of the study were the Grade 5 participants who were in mixed dentition stage. This is because at early age the children should be taught of the proper and recommended brushing and post-brushing methods so that they can adapt it through adulthood. Following the proper brushing with recommended amount of toothpaste is critical to the mixed dentition stage especially if their parents are not knowledgeable about oral hygiene either. Parents play an important role in implementing this post-brushing method they should guide their child in doing dry-toothbrushing method until their child get used to this method. Doing this method consistently can lessen the prevalence rate of the dental caries.

On table 3, the t value of (-2.38) indicates that there is a significant difference between the control and the experimental group while the p value (0.024) rejects the null hypothesis. The outcome confirms that there is, in fact, a substantial difference between the controlled and experimental group. The table shows consistent result as where the dry-toothbrushing method of experimental group is more effective than that of the wet toothbrushing method of the controlled group. The Oral Health Foundation (2016), urges people to "spit don't rinse" after brushing their teeth because new research indicates that rinsing may be harmful to our oral health. This is because when we rinse, the water reduces the fluoride concentration inside the oral cavity and the recommended optimal fluoride amount for each age group would not be met. There would still be a minimal fluoride concentration in the saliva when you rinse with water but less than compared to the dry-toothbrushing method. Insufficient fluoride concentration in the oral cavity plus the frequent intake of sugary foods and beverage in children contributes to the acid production in the oral cavity and decrease the pH level of the saliva. The normal pH level of the saliva is 6.5-7.2, below 6.5 the saliva becomes acidic and when this pH level becomes lower than 5.5

(critical level) the teeth start to demineralize. Decrease of pH level due to the frequent intake of sugary foods and beverage plus the low concentration of fluoride when one rinses with water is a great factor in developing dental caries. The most important thing is that practicing good oral hygiene every day with proper post-brushing method will help prevent dental caries and other oral diseases.

## **Conclusion**

As a result, it is found that there is significant difference in the salivary pH level of both control group (Wet-toothbrushing) and experimental (Dry- toothbrushing). There is a substantial increase in salivary pH after Dry-toothbrushing. This implies that Dry-toothbrushing is effective in attaining the normal salivary pH level in children as compared to the traditional way of toothbrushing.

- The consumption of sugary food may contribute in decreasing the salivary pH in the oral cavity. As a result, it will lead to dental erosion and development of bacteria on the tooth surfaces.
- Based on the results, the use of fluoridated toothpaste will promote the release of fluoride in the oral cavity. Compared to control group, which is the traditional way of toothbrushing, there is an increased salivary concentration than experimental group. According to Sotthipoka et al (2018), fluoride concentration in the saliva after toothbrushing are directly proportional to the caries preventive effect. Therefore, toothbrushing alone is a preventive way.
- Based on the results of the study, there is a substantial increase in salivary pH after brushing without rinsing with water. It is therefore concluded that Dry- toothbrushing is the most effective way of maintaining the normal salivary pH in the oral cavity as compared to the traditional wet toothbrushing. According to PPDSI (2022), the proper method of rinsing the toothpaste after toothbrushing is spitting out the excess toothpaste and no water rinsing. In this method of toothbrushing, the fluoride will retain in the oral cavity for longer time and it will maximize the beneficial effect of fluoride in the teeth and helps in prevention of dental caries.



## **Recommendations**

As a result of this study, the following are hereby recommended:

- **Children Participants (10-11 years old).** The pupils should continue doing the dry-toothbrushing method for two minutes at least two times a day. This study also encourages the children to lessen the intake of sugar and drink more of water since their age is more susceptible to caries. The knowledge and experience they got after the experiment will help them understand the dental caries process and the important role of dry-toothbrushing method in increasing their salivary pH level. If the participants adapt these methods until they grow up their teeth will become resistant to dental caries.
- **Parents.** Parents are recommended to use dry-toothbrushing. Through this study will recommend the parents to supervise their child during brushing to monitor the right amount of toothpaste, duration of brushing and the possibility of eating up the excess toothpaste to prevent fluorosis.
- **Other age group of individuals.** The other age group should use dry-toothbrushing method because it would be beneficial, specially to elders, even if they have different oral health care needs. According to Hausen (2003), fluoride toothpaste reduces caries and works better in persons who have more disease.
- **Barangay Sampaloc V.** It is recommended for the barangay to engage in different oral health programs according to age like community education on proper toothbrushing and rinsing. The locals will adapt the Dry toothbrushing method and if being consistent the prevalence of dental caries in the barangay will decrease.
- **Future Researchers.** It recommends for the future researchers to expand their study by including a duration (i.e., collecting the salivary samples for hours after the post brushing method) before collecting the post samples of saliva to test the retention of fluoride and its relation to maintain the optimal pH level. The future researchers can also use this study into different age group with different dentition to know if the effect to younger group (primary dentition) older group 9 permanent dentition) is similar to the mixed dentition.

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## Effects of Cell-free Supernatant (CFS) Derived from a *Lactobacillus paracasei* towards the Expression of Panton- Valentine Leukocidin gene in Methicillin-resistant *Staphylococcus aureus* (MRSA)

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### KEYWORDS:

- **Gene expression**
- ***Lactobacillus***
- ***Staphylococcus***
- ***pvl* gene**
- **Virulence-associated gene**

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**Abstract** Down-regulation of *pvl* gene is seen as a promising approach to prevent skin and soft tissue infections, and leukocyte destruction in Methicillin-resistance *Staphylococcus aureus* (MRSA). This in vitro study evaluated the ability of cell-free supernatant (CFS) of *Lactobacillus paracasei* to inhibit growth of MRSA and modify the

expression of *pvl* gene. Standard techniques were used for isolation and identification of MRSA and *L. paracasei*. The Agarose Gel Electrophoresis were used to identify MRSA isolates

carrying *pvl* gene. The *L. paracasei* CFS was applied to MRSA isolates containing *pvl* gene, and the gene expression level were quantified using a Real-Time Polymerase Chain Reaction. Analysis revealed that *pvl* gene were found 100% in the isolated 10 MRSA sample. The *L. paracasei* CFS had obvious antimicrobial activity against MRSA 1, 4, 6, 8, and 10, and the Minimum Inhibitory Concentration values for these isolates treated with *L. paracasei* acidic CFS were 50% v/v concentration. The Real-Time PCR exhibited that *L. paracasei* CFS suppressed the expression of *pvl* gene in MRSA 4 and 8 however, it did not suppress the expression of *pvl* gene in MRSA 6 and 10. The relative fold change of *pvl* gene in MRSA 4, 6, 8, and 10 were 0.96, 1.12, 0.52, and 1.70, respectively. The p-value of 0.91 indicates that there is no significant difference in the expression of *pvl* gene between treated and control samples. In conclusion, treatment with *L. paracasei* CFS at 25% v/v concentration can still affect the expression of *pvl* gene in MRSA samples but not significantly.



## **Effects of Cell-free Supernatant (CFS) Derived from a *Lactobacillus paracasei* towards the Expression of Pantone- Valentine Leukocidin gene in Methicillin- resistant *Staphylococcus aureus* (MRSA)**

### **INTRODUCTION**

*Staphylococcus aureus* is a common opportunistic and commensal pathogen found on the skin and environment. Humans are the common and major reservoir of *S. aureus*. Colonization of this species can be found mainly on the nose and nares of the human skin (Tong et al., 2015). It causes several diseases ranging from mild skin infections such as impetigo, folliculitis, and carbuncles; to toxin-mediated conditions such as toxic shock syndrome and food poisoning; and severe infections like staphylococcal bacteremia and endocarditis (Mahon, 2019).

Penicillin was a drug of choice to treat *S. aureus* infection, however, some strains have developed resistance due to misuse of antibiotics. In the past decades, more dangerous Staphylococci have emerged that are resistant to antibiotics called  $\beta$ -lactams such as erythromycin, clindamycin, tetracycline, etc. (Siddique, 2023). Methicillin-resistant *Staphylococcus aureus* (MRSA) carries the *mecA* gene that encodes for the production of a mutated protein called penicillin-binding protein (PBP2A) that confers resistance to all  $\beta$ -lactam antibiotics (Okwu et al., 2019).

Virulence-associated gene (VAG) produces numerous virulence factors of *S. aureus* including exotoxin, exfoliative toxin, and Pantone-Valentine leukocidin (Penuliar, 2021). According to Ahmad et al., (2020), MRSA contains a *pvl* gene responsible for encoding Pantone-Valentine leukocidin (PVL). It is a cytolytic toxin composed of S and F subunits encoded by the lukPV operon important for destroying immune cells (Valle Jr. et al., 2016). Karmarkar et al., (2020) stated that PVL has become the most significant and important virulence factor of hospital-acquired MRSA (HA-MRSA) and community-

acquired MRSA (CA- MRSA). It causes severe infections such as necrotizing pneumonia, necrotic lesions, and furunculosis (Ahmad et al., 2020). Prevalence of PVL in *S. aureus* is the most common cause of bacteremia and suggested that further research is necessary to study the potential management of PVL virulence factor (Darboe et al., (2019).

Based on the statistic report of the Department of Health-Antimicrobial Resistance Surveillance Reference Laboratory (DOH-ARSP), as of 2022, there were 1,949 isolates of Methicillin-Resistant *Staphylococcus aureus* (MRSA) in the Philippines. MRSA isolates from 2022-2020 are mostly isolated from males than females and within the age of 20-64. Additionally, according to their report, the majority of these isolates came from wound samples at 38.3%, followed by blood at 27.2%, and lastly from respiratory samples at 17.1%. This only shows that the current statistic is slightly higher in comparison to the years 2021 and 2020 which are reported to have 1,644 and 1,662 isolates, respectively. In the study of Valle Jr. et al., (2016) they performed MRSA molecular surveillance from a tertiary hospital in the Philippines and found that *lukS-PV* and *lukF-PV* genes were detected in 41 cases (38%) out of 108 MRSA isolates. The prevalence rate of the *pvl* gene in a Philippine hospital was unexpectedly higher compared to other foreign hospitals of Cyprus, Palestine, and South Africa with 26%, 31%, and 25% prevalence rates of *pvl* genes in all confirmed MRSA isolates respectively (Ahmin et al., 2020; El Aila et al., 2023; Singh-Moodley et al., 2019).

Demand for alternative treatments for infectious pathogens with maximum efficacy and minimum side effects is increasing (Dehkordi et al., 2017). Anti-virulence drugs are considered potential non-antibiotic- based alternatives to the failing effect of antibiotic drugs due to the consistent development of pathogen resistance (Ahmed et al., 2018). Probiotics, specifically, *Lactobacillus paracasei* are commonly used in foods because of their safety, efficacy, and physiological effects on the body (Pimentel et al., 2021).

Furthermore, as per Wergin (2022), probiotics help to improve the normal flora in the gut. They are normally called the good bacteria in the stomach which fights off the bad bacteria to have a good digestion and immunity. They restore the natural balance of the digestive tract and are normally found in yogurt or supplements.

Hydrogen peroxide, biosurfactants, bacteriocins, organic acids, fatty

acids, reuterin, microcin, and bioactive peptides are the different inhibitory molecules secreted by *Lactobacillus* with significant antimicrobial activity and various mechanisms of action to suppress bacterial growth and proliferation such as oxidation of membrane proteins and DNA damage, disruption of membrane integrity and pore formation, inhibit cell wall synthesis, inhibit quorum sensing, and expression of related virulence genes (Nataraj et al., 2021; Vincenzi et al., 2021). Many studies have been able to demonstrate the potential of the *Lactobacillus* genus in controlling infectious pathogens in vivo and in vitro. Much literature has been conducted over the past years on the antagonistic interactions of probiotics including microorganism growth inhibition, quorum sensing inference, and competitive exclusion (Piatek et al., 2020; Davares et al., 2022; Melo-Bolivar et al., 2022). However, limited studies tested the capability of *Lactobacillus* to affect the expression of VAG. Further research is needed to understand the capability of *Lactobacillus* to suppress pathogen virulence factors (Coulatti et al., 2022). Moreover, the employment of molecular methods to correctly identify and manage MRSA infection is increasing (Penuliar, 2021).

The bioactive metabolites secreted by probiotics have been subjected to several studies because of their biotherapeutic ability to combat pathogenic infections. Despite exhibiting antibacterial effects, probiotics may also influence the expression and regulation of virulence genes however, limited studies have attempted to understand the mechanism (Nataraj et al., 2021). Given the existence of several theories to explain the mode of action of probiotics, the primary objective of this study was to explore the ability of commonly isolated probiotics from a fermented dairy product to interfere with the virulence gene responsible for MRSA soft tissue infection. This study will support the conduct of new strategies for reducing the risk of infection and the development of antimicrobial resistance pathogens due to antibiotic misuse in the Philippines. Thus, this study aims to investigate the effect of cell-free supernatant from *L. paracasei* in the expression of the *pvl* gene in MRSA at the transcriptional level.

## **METHODOLOGY**

### **Research Design**

In this study, a true experimental research design will be used to investigate the effect of cell-free supernatant (CFS) to *pvl* gene expression. This research design will help the researcher prove or disprove the hypothesis formulated. Mediating, moderating, and control variables can be controlled and manipulated to establish causality. Also, this research design supports the employment of pre- and post-treatment samples, which is particularly important in effectively comparing *pvl* gene expression of treatment and control groups. This research design can track, assess, and ensure that the intervention effectively modulates gene expression.

### **Sampling Procedure**

The researchers will use a purposive sampling technique to select the study sample. This sampling method will enable the researchers to accurately and efficiently choose the sample based on the appropriate characteristics. Collected clinical isolates of *S. aureus* from Emilio Aguinaldo College Medical Center (EACMC) and Gentri Medical Center and Hospital, Inc. will be used for the identification and confirmation of phenotypic and genotypic characteristics of the isolates. Confirmed MRSA that are *pvl* gene- positive will be subjected to gene expression analysis. The sampling technique used is highly accurate and relevant to the context of this research experiment.

### **Data Gathering Procedure**

The researchers collected the data via experimentation and followed the standardized protocol set by the researchers and mother journals. Culture media plates of MRSA isolates that are for disposal were requested at EACMC and Gentri Medical Center and Hospital, Inc, as well as to conduct the study and utilize laboratory equipment at Emilio Aguinaldo College – Cavite. After collecting all MRSA culture media plates, it was subjected to biochemical testing for phenotypic identification of *S. aureus*. Next, an antibiotic susceptibility profile test is performed to differentiate MRSA from MSSA by measuring the zone of inhibition from the cefoxitin disc, following the guidelines from the 31st edition of M100 of CLSI. A Microplate reader was used to assess the initial and final OD<sub>620</sub>

absorbances of the test samples. A Nanodrop Spectrophotometer was utilized to confirm the DNA concentration and purity. Extracted DNA was then subjected to PCR analysis. Then, gel electrophoresis was performed to visualize the band pattern of the *pvl* gene after PCR amplification.

*L. paracasei* was isolated from a probiotic drink. CFS was extracted after 48 hours of incubation. *pvl* gene-positive MRSA samples were mixed with CFS for ~20 hours of contact time. RNA concentration and purity were determined at Nanodrop Spectrophotometer, then proceeded to RT-qPCR assay. The yielded Ct values from qPCR were used to analyze the gene expression of *pvl* gene.

### **Data Analysis Procedure**

To determine the effect of CFS on *pvl* gene expression, the researchers will calculate the Fold Change to assess whether the *pvl* gene is upregulated or downregulated. RT-qPCR Ct values from the control, treatment group, and housekeeping gene will be used to calculate the Fold Change. Fold Change ( $>1$ ) indicates an increase in gene expression or up-regulation, whereas a Fold Change ( $<1$ ) indicates a decrease in gene expression or down-regulation (Clark Science Center Smith College, 2015). Also, this study will use the Student's T-test to analyze and assess the statistically significant difference between test and control groups as well as to compare the significant change in the expression of the *pvl* gene between MRSA test subjects. P value  $\leq 0.05$  or 5% at a 95% confidence interval is considered statistically significant.

### **Sample Collection**

Clinical isolates were collected from EACMC and Gentri Medical Center and Hospital Inc. Collected samples were placed on Blood Agar Plates (BAP) with laboratory-confirmed Methicillin-Resistant *S. aureus* that is for disposal. The target isolates were 10 samples of MRSA. The samples were taken between 03 January 2024, and 15 April 2024. The collected MRSA samples were identified via routine laboratory procedures to confirm their phenotypic characteristics such as gram staining, catalase, coagulase, and growth on Mannitol Salt Agar. A molecular test was also performed for genotypic identification of *pvl* gene.

## **Bacterial Strains and Growth Condition**

The *pvl* gene positive control strain for Methicillin-Resistant *S. aureus* is ATCC 25923. ATCC control was obtained from EACMC. Clinical isolates of MRSA were sub-cultured in Mannitol Salt Agar (Beef Extract 1.0 g, Pancreatic Digest of Casein 5.0 g, Peptic Digest of Animal Tissue 5.0 g, Sodium Chloride 75.0 g, D-Mannitol 10.0 g, Phenol Red 0.025 g, Agar 15.0g/L.) for 24-36 hours at 37 °C. *L. paracasei* was sub-cultured to Man, Rogosa, and Sharpe agar (Proteose Peptone No. 3 10.0g, Beef Extract 10.0 g, Yeast Extract 5.0 g, Dextrose 20.0 g, Polysorbate 80 1.0 g, Ammonium Citrate 2.0 g, Sodium Acetate 5.0 g, Magnesium Sulfate 0.1 g, Manganese Sulfate 0.05 g, Dipotassium Phosphate 2.0 g/Agar 15.0 g/L) at 37 °C for 48 hours under anaerobic condition (5% CO<sub>2</sub>) and to MRS broth overnight at 37 °C for 48 hours. Brain Heart Infusion broth (Infusion from Brain Heart 6.0 g, Peptic Digest of Animal Tissue 6.0 g, Pancreatic Digest of Gelatin 14.5 g, Sodium Chloride 5.0 g, Dextrose 3.0 g, Disodium Phosphate 2.5 g/L) is used to propagate the growth of MRSA at 37 °C for 24 hours.

## **Cefoxitin Susceptibility Testing**

All clinical isolates were subjected to Antibiotic Susceptibility Testing (AST) following the 31<sup>st</sup> edition of M100 of Clinical and Laboratory Standards Institute (CLSI) guidelines. The Kirby-Bauer Disk Diffusion Susceptibility Test is performed to determine the sensitivity or resistance of the isolates to the 30- ug cefoxitin disc. A 0.5% McFarland standard of colony suspension was lawn cultured on a Mueller-Hinton Agar (MHA) plate before placing the 30-ug cefoxitin antibiotic disc. MHA plates were then incubated overnight ~16 hours at 37 °C. MHA plates are read in reflected light and the zone of inhibition is measured using a calibrated caliper.

## **Isolation and Purification of Genomic DNA from MRSA Isolates**

The DNA extraction was performed using Wizard<sup>®</sup> Genomic DNA Purification Kit (Promega, USA). The overnight culture of 10 MRSA isolates was centrifuged for 2 mins to get the pellet cells. They were suspended in 1 mL of Normal Saline solution (NSS) and washed 2x times before lytic enzyme was added and then incubated at 37 °C for 60 mins. Following incubation, the mixtures were again

centrifuged for 2 mins before the addition of 600 uL of Nuclei Lysis solution, then incubated once more at 80 °C for 5 mins. After incubation, 3 uL of RNase solution was added before another incubation, this time at 37 °C for 45 mins. The solutions were cooled at room temperature before the addition of 200 uL Protein Precipitation Solution. They were vortexed then incubated on ice for 5 mins, transferred to a spin column, and centrifuged for 3 mins. Following the protein precipitation, DNA precipitation, and rehydration were done by transferring the supernatant of the 3 solutions to new tubes which contained 600 uL of isopropanol each. They were centrifuged again before the addition of 600 uL of room temperature 70% ethanol. After that, the tubes were centrifuged for the last time for 2 minutes before aspirating the ethanol and air-drying the pellet for 15 mins. The DNA pellets were rehydrated using 100 uL of Rehydration solution overnight at 4°C. The concentration and quality of extracted DNA in 260/280 ratio and 260/230 ratio were assessed using a Nanodrop 300 Microspectrophotometer (iGene Labservice).

### **Panton-Valentine Leukocidin gene Detection**

Phenotypically isolated and confirmed MRSA isolates were further evaluated by Polymerase Chain Reaction (PCR) amplification. To verify the presence of the *pvl* gene, the researchers employed a Gradient Thermocycler TC 9639 (Benchmark Scientific). The primers used for *pvl* gene are listed on *Table 1*. These primers amplified 433 bp fragments from *pvl* gene of MRSA isolates. The PCR recipe was computed according to DNA concentration. The PCR was carried out in a PCR tube with 20uL volume reaction and each of the reaction mixtures contained 12.5 uL Hotstart PCR GoTaq Master Mix 2x (Promega), 2 uL of reverse and forward primers (10 pmol/uL), varying volume of DNA template (<100 ng/mL), and varying volume of Nuclease-Free Water. The Gradient Thermocycler TC 9639 setting was set for the initial denaturation step programmed at 94 °C for 3 mins. This is followed by 35 cycles of amplification comprised of 1 min of denaturation at 94 °C, 30 seconds of annealing at 55 °C, and 1 min of extension at 72 °C. After the cycles, the final extension was done for 10 mins at 72 °C. After PCR, the visualization of the products was done using gel electrophoresis. Five microliter of the PCR amplicon per sample was loaded into a 1.0% agarose gel, and run for 50 mins at 120V. The marker used is Invitrogen 1kb plus (L) and the bands were seen using the BioMetra Compact M (Standard Power Pack P25 T).

Table 1. *pvl* gene and 16s rRNA Forward and Reverse Primer Sequences

Target Gene	Direction	Primer Sequences	Fragment Size	Reference
<i>pvl</i>	F	5'-ATCATTAGGTAATAATGCTGGACATGATCCA-3'	433bp	McClure et al., (2006)
	R	3'-GCATCAAGTGTATTGGATAGCAAAAGC-5'	433bp	
16s rRNA	F	5'-GTAGGTGGCAAGCGTTATCC-3'	228bp	Monday and Bohach (1999)
	R	3'-CGCACATCAGCGTCAG-5'	228bp	

Isolation of *Lactobacillus paracasei* and Preparation of Cell-free Supernatant (CFS)

A five (5) ten-fold serial dilution was performed to isolate the probiotic strain from a well-known probiotic product, Yakult. As labeled on the product container, it has a live and active *L. paracasei* strain. A 1 mL aliquot of solution from Yakult stock solution was added to a tube of 10<sup>-1</sup> which contained 9 mL of distilled water. Aliquoting of 1 mL from a newly created solution continues until the final tube of 10<sup>-5</sup> was reached, diluting the stock solution by a factor of 10 with each tube. A 0.1 mL of solution from each serially diluted tube was streaked at de Man, Rogosa, and Sharpe (MRS) agar, a selective and differential media used to propagate *Lactobacillus spp.* MRS agar was incubated for 48 hours at 37°C under anaerobic conditions (5% CO<sub>2</sub>), as per the manufacturer protocol (HIMEDIA). The CFS of *L. paracasei* was obtained as previously described by Drumond et al., (2023). *L. paracasei* was grown in MRS medium overnight and incubated at 37°C for 24 hours. The overnight culture cells were precipitated by Z216 MK Micro Refrigerated Centrifuge (HERMLE) at 6,000g at 4°C for 10 min. The supernatant was filtered through a 0.2-mm-pore-size syringe filter (SimPure, USA) to remove the residues of viable cells. After filtration, the CFS pH was adjusted to ~7 using 1 N of NaOH. Also, some of the filtered CFS extracts were not neutralized. The prepared CFS was aliquoted in 100 uL and was plated on an MRS agar and incubated for 48 hours at 37°C under anaerobic conditions (5% CO<sub>2</sub>) to ensure the absence of LAB viable cells and to rule out bacterial contamination.



### **Determination of Minimum Inhibitory Concentration of *L. paracasei* Cell-free Supernatant**

The minimum inhibitory concentration of each MRSA sample was determined according to the Clinical and Laboratory Standard Institute (CLSI). MIC determination involved using 96-well microplates, each well (A1-5 to G1-5) contained a 100uL BHI broth, 100uL serially diluted CFS (100% v/v, 50% v/v, 25% v/v, 12.5% v/v, 6.25% v/v, 3.13% v/v and 1.53% v/v), and  $1.5 \times 10^8$  CFU/mL bacterial suspension. Vancomycin was used as a drug control. Sterility control (BHI + serially diluted CFS) and growth control (BHI + inoculum) were also included in the microplate. The microplate was covered with parafilm and incubated at 37 °C for ~20 hours. Following the incubation, the last well that shows turbidity was considered as the minimum inhibitory concentration of the CFS. The incubated 96-well microplates were read at MR- 960 (Perlong Medical Equipment Co., Ltd) at OD<sub>620</sub> nm. The absorbance obtained was used in the calculation of percentage growth inhibition and was correlated with macroscopic visualization of MIC using this formula:

$$\% \text{ cell inhibition} = 100 - \{(At - Ab) / (Ac - Ab)\} \times 100$$

Where,

**At**= Absorbance value of test compound

**Ab**= Absorbance value of blank

**Ac**= Absorbance value of control.

### **Contact between Concentrated CFS and *pvl* gene-positive MRSA**

An OD<sub>620</sub> of BHI broth without inoculum was measured to rule out bacterial contamination. A colony of *pvl* gene-positive MRSA was taken and inoculated in 4 mL BHI broth. Control tube, and treatment tube for each isolate were prepared. Bacterial suspension after ~20 hours at 37 °C of incubation is measured by OD<sub>620</sub> to check for bacterial growth. The cultures were then diluted until they reached an OD<sub>620</sub> = 0.05 by mixing 3mL of sub-MIC CFS supplemented with 0.5 mL BHI broth and then incubated at 37 °C until they reached an early stationary phase (OD<sub>620</sub> = 1) with some modifications in the procedure recommended by (Bayoumi and

Griffiths, 2012). After incubation, bacterial pellets for RNA extraction were collected by centrifugation at 12000 x g for 10 minutes at 4 °C.

## **RNA Extraction**

RNA extraction was performed using the RADI PREP DNA/RNA kit (KH Medical Co., Germany). In their corresponding 1.5 mL microcentrifuge tubes, 200 uL of cell pellets from three different MRSA isolates were added as well as 250 uL of KSB buffer, 20 uL of Proteinase K, and 5 uL of Carrier molecule. The tubes were vortexed thoroughly for 10 seconds before incubating at 56 °C for 10 mins. Absolute ethanol of 350 uL was added to the mixtures and once more vortexed for 10 secs. All the mixtures were dispensed into the spin column and centrifuged at 10,000 rpm for 1 min. Following centrifugation, the mixtures were placed into new collection tubes, and then 50 uL of KSW1 buffer was added to the spin columns and again centrifuged at 10,000 rpm for 1 min. New collection tubes were prepared to transfer the mixtures, and 500 uL of KSW2 buffer was added before centrifugation at full speed of 13,000 rpm for 3 mins. After that, the spin columns were transferred to new microcentrifuge tubes, and 70 uL of KSE buffer was added to the spin columns before incubating them for 1 min at room temperature. The mixtures were further centrifuged at 10,000 rpm for 1 min. The concentration and quality of extracted RNA in 260/280 ratio and 260/230 ratio were assessed using a Nanodrop 300 Microspectrophotometer. Lastly, the extracted RNA samples were stored at -30 °C to -15 °C prior to assay.

## **Reverse Transcription Quantitative Polymerase Chain Reaction (RT-qPCR) for Gene Expression Analysis**

Extracted RNA was reverse-transcribed into cDNA using a Thermocycler. The two-step qRT-PCR approach was used with the LunaScript® RT SuperMix Kit and the Luna® Universal qPCR Master Mix (New England Biolabs, USA). The cDNA synthesis was performed with a total volume of 20 uL, containing 4 uL LunaScript RT SuperMix, varying volumes of RNA (<100 ng/mL), and up to 20 uL of nuclease-free water. At the same time, the no-RT control was also prepared with a total volume of 20 uL, including 4 uL of no-RT control mix, varying volumes of RNA (<100 ng/mL), and up to 20 uL of nuclease-free water. Lastly, No-template control was also prepared with a total volume of 20 uL, including 4 uL of LunaScript

RT SuperMix and 16  $\mu$ L of nuclease-free water. Gradient Thermocycler TC 9639 (Benchmark Scientific) was used with an initial incubation at 25  $^{\circ}$ C for 2 mins, followed by cDNA synthesis at 55 $^{\circ}$ C for 10 minutes, then heat inactivation at 95  $^{\circ}$ C for 1 min. The setting for reverse transcription was set according to the LunaScript<sup>®</sup> RT SuperMix Kit protocol. Synthesized cDNA was assessed on Nanodrop 300 Microspectrophotometer to check for sample purity and concentration. Dye-based (SYBR<sup>®</sup> Green I) quantitative PCR was performed using a MA-6000 Real-Time Quantitative Thermal Cycler (Molarray Research Inc.). The qPCR cycling program was adjusted according to Luna<sup>®</sup> Universal qPCR Master Mix protocol, including initial denaturation at 95  $^{\circ}$ C for 60 secs for 1 cycle, followed by 40-45 cycles of denaturation at 95  $^{\circ}$ C for 15 secs, an extension at 60  $^{\circ}$ C for 30 secs, then a melt curve at 60-95  $^{\circ}$ C with a heating rate of 0.1  $^{\circ}$ C/s. The primers used for qPCR assay are listed in Table 1. The qPCR reaction volume was 20  $\mu$ L, including 10  $\mu$ L Luna Universal qPCR Master mix, 0.5  $\mu$ L of 16s rRNA and pvl primer (10 pmol), varying volume of DNA (<100 ng/mL), and up to 20  $\mu$ L nuclease-free water. The  $\Delta\Delta$ Ct method, also known as the 2 $^{-\Delta\Delta$ Ct} method was used to calculate the expression ratio (fold) of the pvl gene with 16s rRNA as a housekeeping gene.

## Statistical Analysis

Comparison of gene expression between test and control groups was analyzed using Student's T- test using a GraphPad Prism (GraphPad Software) version 10.2.3. A P value of  $\leq 0.05$  (5%) at a 95% confidence interval is considered statistically significant. The experiments were replicated three times to ensure the reliability of the results.

## Ethical Consideration

This research study was given an ERC Code 2024-01-032 issued on March 25, 2024 by the EACC Ethics Review Committee. This study has undergone review by the members of the EACC Ethics Review Committee and granted approval because it has been found free from ethical issues and violations set forth by the EACC Ethics Review Committee. The EACC Ethics Review Committee exempted this study from review because the protocol does not involve human subjects. This study may proceed according to plan.

## RESULTS & DISCUSSION

A total of ten (10) laboratory-identified MRSA clinical isolates were successfully collected from EACMC and Gentry Medical Center and Hospital, Inc. This study focused on isolation of MRSA species; therefore, samples containing other strains were excluded from the study.

### Phenotypic Identification of MRSA isolates

*S. aureus* presence in collected clinical isolates were verified using a number of routine laboratory methods. As can be seen in figures below, these strains were shown to have a growth on Mannitol Salt Agar and clot formation of 0.5 mL rabbit plasma on Coagulase Test after 24 hours of incubation. Effervescence was observed which indicates a positive result on Catalase Test. Gram Stain shown distinct purple appearance with cocci cell morphology. These laboratory tests results are significant in identifying and confirming *S. aureus* (Mahon, 2018); thus, the clinical isolates were included in the succeeding experiments.

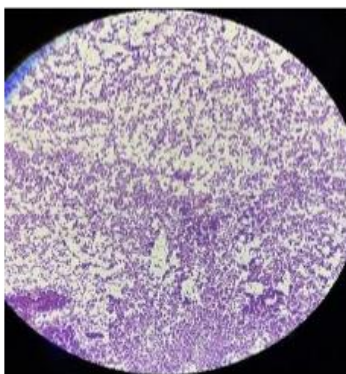


Figure 1. Gram Stain

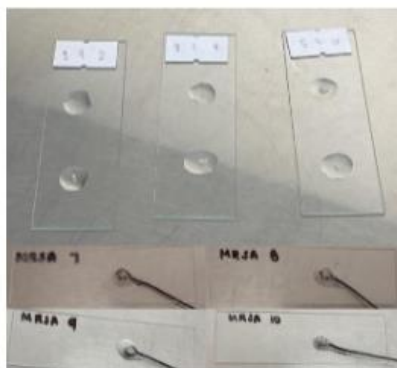


Figure 2. Catalase Test

*Effects of Cell-free Supernatant (CFS) Derived from a Lactobacillus paracasei towards the Expression of pvl gene in Methicillin-resistant Staphylococcus aureus (MRSA)*

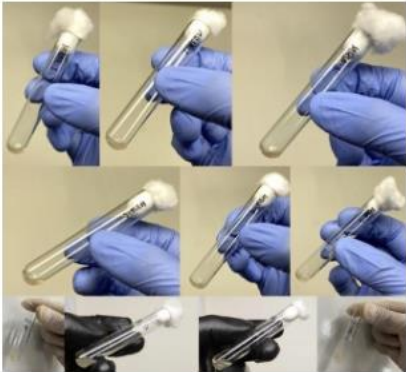


Figure 3. Coagulase Test

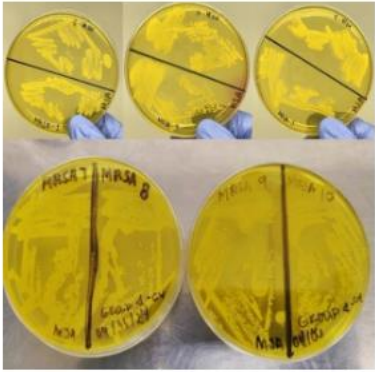


Figure 4. Growth on Mannitol Salt Agar

**Cefoxitin Susceptibility Test**

MRSA were identified based on their zone of inhibition to cefoxitin. An inhibition zone diameter measure of  $\leq 21$  mm is reported as cefoxitin resistant and identified as MRSA and  $\geq 22$  mm as cefoxitin susceptible and identified as MSSA. As can be seen on Table 2, these strains were shown to have  $< 21$  mm zone of inhibition diameter, thus the 10 clinical isolates are considered to be MRSA.

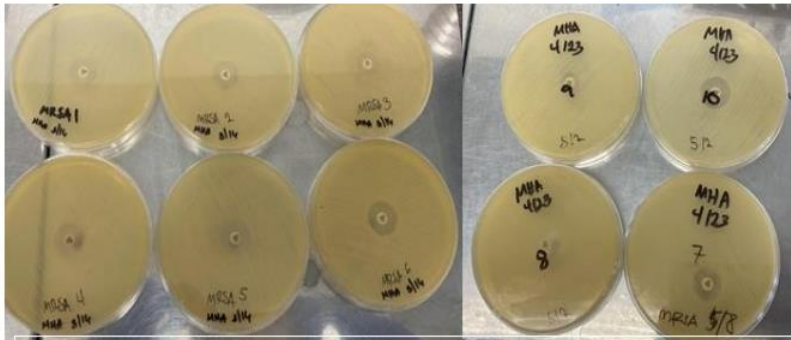


Figure 5. Cefoxitin Susceptibility Profile of MRSA Samples on Mueller Hinton Agar (MHA).

Effects of Cell-free Supernatant (CFS) Derived from a *Lactobacillus paracasei* towards the Expression of *pvl* gene in Methicillin-resistant *Staphylococcus aureus* (MRSA)

Table 2. MRSA samples Zone of Inhibition to Cefoxitin

MRSA Isolates	Zone of Inhibition Diameter (mm)	MRSA Isolates	Zone of Inhibition Diameter (mm)
MR1	17 mm	MR6	17 mm
MR2	17 mm	MR7	15 mm
MR3	15 mm	MR8	6 mm
MR4	16 mm	MR9	3 mm
MR5	17 mm	MR10	16 mm

Extraction of Probiotic Strain from Yakult

*L. paracasei* colony morphology appears as small to large white colonies after 48 hours at 37 °C under anaerobic condition (5% CO<sub>2</sub>) at MRS agar. Further identification of the isolates via gram staining, catalase, and Sulfide Indole Motility (SIM) was performed. Gram stain result showed a gram-positive plump to slender rods, long and short, in chains, clusters and palisades morphology. Catalase test showed no effervescence. Motility of the isolated strain was observed on SIM and showed no turbidity on the stab. Hence, the isolated probiotic strain is gram-positive rod, catalase negative, and non-motile. This feature was correlated to the distinct characterization of *Lactobacillus* spp. (Mahon, 2019).

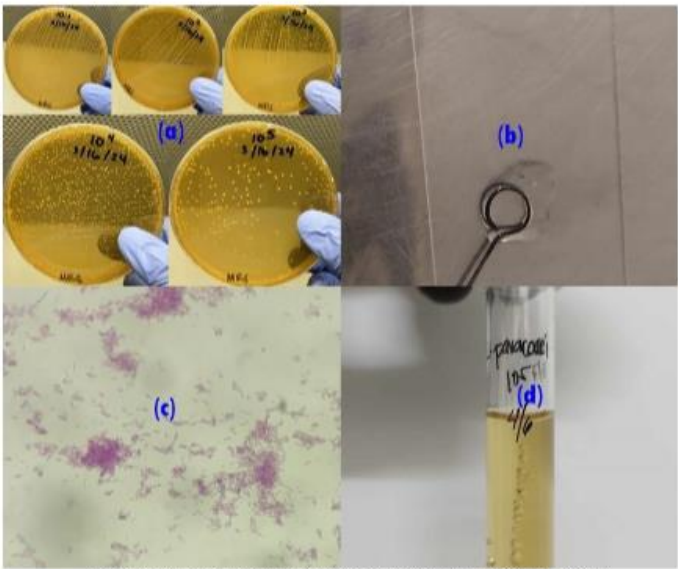


Figure 5. (a) MRS Agar; (b) Catalase Test; (c) Gram Stain; (d) SIM

## Genotypic Identification of MRSA

The genomic identity of the 10 clinical MRSA isolates including the positive control ATCC 25923 was amplified and shows band migration at ~300 to 400 bp through Agarose Gel Electrophoresis (AGE) with primer dimers. In contrast, the negative control was not amplified and shows no band migration. *Figure 6* demonstrated that the 10 clinical MRSA isolates were positive for *pvl* gene. The band migration was correlated according to the expected *pvl* gene band migration at 433bp (Kamakar et al., 2018; McClure et al., 2006). Only 5 samples were carefully selected for gene expression analysis whose band showing an intense luminosity pattern (1, 4, 6, 8, and 10).

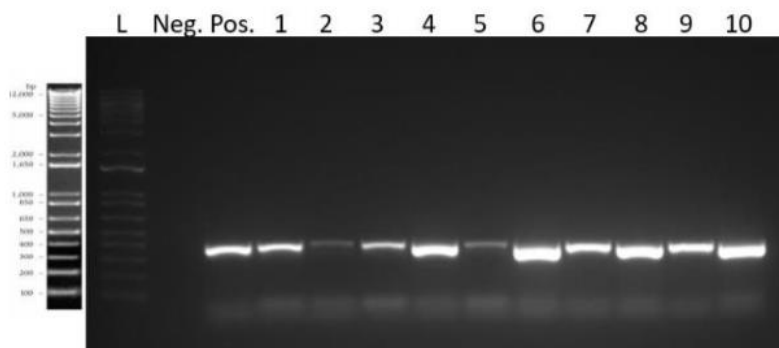


Figure 6. Agarose Gel Electrophoresis (AGE) profile showing ladder (L), negative control (Neg.), positive control (Pos.), and MRSA clinical isolates 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10.

## Antibacterial Activity of *L. paracasei* CFS against *pvl*-gene positive MRSA

The antimicrobial activity of the *L. paracasei* was examined against *pvl* gene-positive MRSA. Findings showed that *L. paracasei* acidic CFS has antimicrobial activity against *pvl* gene-positive MRSA samples 1, 4, 6, 8, and 10. In contrast, neutralized CFS has shown no antimicrobial activity as depicted on *Figure 7* because all wells with serially diluted neutralized CFS were turbid. The turbidity observed in microplate wells were compared to drug control (*Figure 8*), prominent turbidity on wells with CFS extracts indicate no antibacterial activity. The last well with no macroscopic turbidity after exposing the 96-well microplate to the light was considered as Minimum Inhibitory Concentration (MIC), thus MIC obtained for MRSA isolates treated with serially diluted acidic CFS concentration

Effects of Cell-free Supernatant (CFS) Derived from a *Lactobacillus paracasei* towards the Expression of *pvl* gene in Methicillin-resistant *Staphylococcus aureus* (MRSA)

in isolates 1, 4, 6, 8, and 10 was about to be 50% v/v.

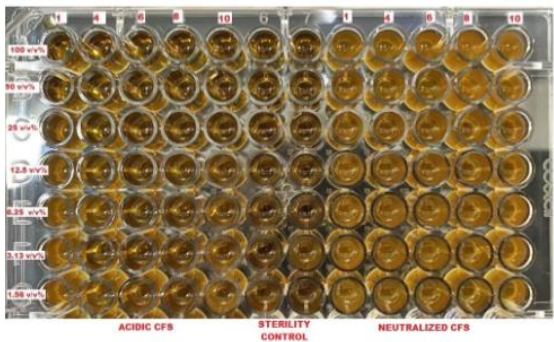


Figure 7. Microdilution Method in Determination of Minimum Inhibitory Concentration of CFS at 96-well microplate

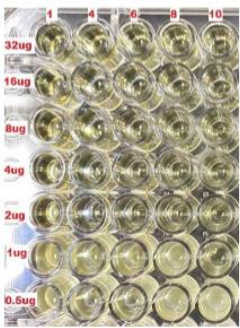


Figure 8. Vancomycin as Drug Control

The percentage bacterial inhibition of serially diluted acidic CFS was computed based from the OD<sub>620</sub> absorbances of the test samples at MR-960. Based on the results shown on *Table 3*, positive percent inhibition of 100%, 96%, and 63% at 100% v/v, 50% v/v, and 25% v/v, respectively, indicates an antibacterial activity. However, negative percent inhibition at 12.5% v/v, 6.25% v/v, 3.13% v/v, and 1.56% v/v indicates bacterial proliferation instead of inhibition.

Table 3. Mean Percentage of Bacterial Inhibition at Different Serial Dilutions of *L. paracasei* Acidic CFS

Concentration of Acidic CFS (% v/v)	<i>pvl</i> -gene positive MRSA 1,4,6,8,10 (mean OD $\pm$ SD)	Mean Percentage Inhibition
100	0.218 $\pm$ 0.001	100
50	0.204 $\pm$ 0.005	96
25	0.233 $\pm$ 0.021	63
12.5	0.368 $\pm$ 0.160	-21
6.25	0.459 $\pm$ 0.182	-90
3.13	0.437 $\pm$ 0.172	-82
1.56	0.553 $\pm$ 0.129	-152



*Effects of Cell-free Supernatant (CFS) Derived from a Lactobacillus paracasei towards the Expression of pvl gene in Methicillin-resistant Staphylococcus aureus (MRSA)*

Percentage inhibition of serially diluted acidic CFS at MRSA 1, 4, 6, 8, and 10 is shown at the *Figure 9*. 100% v/v, 50% v/v, and 25% v/v shows a positive percentage inhibition to all MRSA samples.

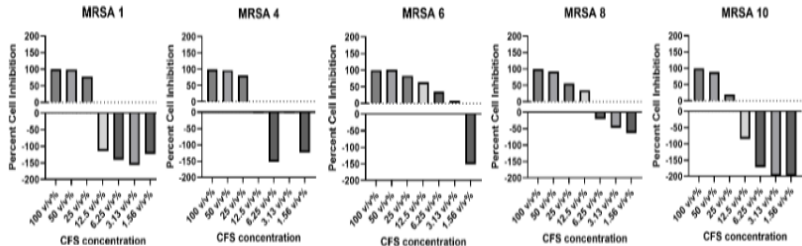


Figure 9. Percentage Bacterial Inhibition of Serially Diluted Acidic CFS against the MRSA samples

### Effect of *L. paracasei* Acidic CFS on MRSA *pvl* gene Expression

The researchers studied the potential effect of *L. paracasei* acidic CFS in gene expression to understand its antimicrobial activity and suppression of PVL production. *pvl* gene expression was analyzed after ~20 hours of exposure to sub-MIC concentration (25% v/v). Using a Real-Time PCR (qPCR), amplification curve was generated according to the Cycle Threshold (Ct) values of MRSA samples. *Figure 10* shows the triplicate run of MRSA samples to qPCR for accuracy and consistency of the amplification. SYBR® Green Dye binds to cDNA and allows the measurement of amplified DNA in real-time. Thus, the average Ct values for MRSA 1, 4, 6, 8, 10 were 28.05, 16.96, 17.24, 17.99, and 17.05, respectively.

*Effects of Cell-free Supernatant (CFS) Derived from a Lactobacillus paracasei towards the Expression of pvl gene in Methicillin-resistant Staphylococcus aureus (MRSA)*

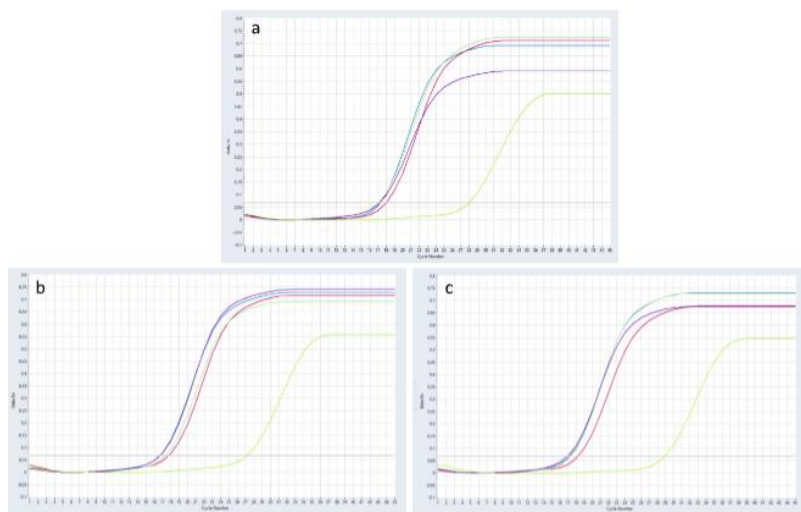


Figure 10. Triplicate (a, b & c) Amplification Curve at Real-Time PCR of MRSA Samples Treated with Acidic CFS  
Neon: MRSA 1, Purple: MRSA 4, Green: MRSA 6, Red: MRSA 8, Blue: MRSA 10.

Results showed that CFS of *L. paracasei* suppressed the expression of *pvl* gene at MRSA 4 and 8 however, expression of *pvl* gene at MRSA 6 and 10 was not affected. MRSA 1 was excluded as test sample because the average Ct values does not fall within the central limit and affected the assumption and result of this study. Expression of the *pvl* gene among MRSA samples treated with *L. paracasei* acidic CFS sub- MIC of 25% v/v concentration was not significantly reduced (*P-value* 0.91). The fold changes of *pvl* gene among MRSA 4, 6, 8, and 10 were 0.96, 1.12, 0.52, and 1.70, respectively as shown in Figure 11. A fold change of <1 means downregulated, whereas a fold change of >1 means upregulated.

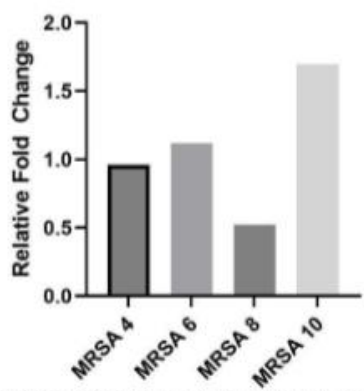


Figure 11. Relative Fold Change of *pvl* gene in CFS-treated MRSA.

SUMMARY & CONCLUSION

The crisis regarding antibiotic resistance has increased during the COVID-19 pandemic and different solutions such as investments for alternative medicine, antibacterial drug discovery, and vaccine development were proposed to prevent and control its progress (Shields, 2024). Since probiotics secrete many metabolites that are not only antimicrobial, but also believed to influence the expression of virulence genes, it gained more attention in the prevention of pathogenic infections (Nataraj et al., 2021). Therefore, the researchers aimed to discover whether the bioactive metabolites found in probiotics, through its cell- free supernatant, can downregulate the expression of the virulence gene of MRSA, specifically the *pvl* gene. The findings of this study indicated that the CFS of *L. paracasei* can only suppress the growth of MRSA because of its antimicrobial ability, however, it cannot impede significantly the gene expression of the *pvl* gene of this antibiotic resistant bacteria. The 100% v/v, 50% v/v, and 25% v/v concentration of the CFS shows no to less turbidity during minimum inhibitory concentration assay, which indicates inhibition of cell growth and proved the presence of its antimicrobial property. This result correlates with the study of Bendjeddou et al. (2012), which claims that an isolated strain of *L. paracasei* from healthy infant's feces used against clinical isolates of MRSA show growth suppression due to its ability to produce a bacteriocin called paracasein. The result of this study also

backs up the claim of Jain et al. (2023), which states that *L. paracasei*, front an ability against emerging resistant infections because of their capability to intercede in pathogen growth, their biofilm formation as well as quorum sensing.

On the other hand, it is worthy to mention that during minimum inhibitory assay, the neutralized CFS shows an absence of antimicrobial activity despite being in high concentration. This may be because the optimum pH for growth of *S. aureus* is between pH 6.0 - 7.0 which is on a neutral part of the spectrum (Hülpüsch et al., 2020). With regard to down regulation of *pvl* gene, the researchers needed the sub minimum inhibitory concentration of the CFS, which is the 25% v/v concentration, since live MRSA isolates are necessary to allow the observation of the gene expression. Based on the result of the RT- qPCR, it shows that only two out of four isolates of MRSA experienced down regulation of the gene while the rest did not. It only indicated that the CFS of *L. paracasei* does not produce significant suppression in the expression of *pvl* gene. This shows discrepancy in the result of the study conducted by Ramezani et al. (2020), which the growth of MRSA was not significantly inhibited with the presence of CFS of *lactobacilli* on a 12-hour period of post-treatment, however their target gene expression was significantly reduced. In addition, another study by Moghadam et al. (2021), also contradicts the result of this study as their result conveyed a reduced level of gene expression of *Staphylococcus* strains against two probiotic bacteria: *Lactococcus lactis* and *Bifidobacterium bifidum*.

As an alternative to the use of conventional antibiotics in treating multi-drug resistant (MDR) bacterial infection, the use of probiotics and their bioproducts shows potential. With these, the use of probiotics such as *L. paracasei* shows a promising result in combating infections caused by MRSA which is in agreement to the result of this study that exhibits an antimicrobial ability to the said pathogen. However, the downregulation of the *pvl* gene expression is not significantly affected by the probiotic.

The present study provides evidence that the use of probiotic *L. paracasei* proved to have antimicrobial ability, as it demonstrated inhibition of the pathogen growth of MRSA. The relative fold change of *pvl* gene in MRSA 4, 6, 8, and 10 were 0.96, 1.12, 0.52, and 1.70, respectively. The p value of 0.91 indicates that there is no significant difference in the expression of *pvl* gene between treated and control

samples. In conclusion, treatment with *L. paracasei* CFS at 25% v/v concentration can still affect the expression of *pvl* gene in MRSA samples but not significantly.

## **FUTURE DIRECTIONS**

This study suggests a utilization of higher concentration of *L. paracasei* CFS for a better demonstration of its bacterial inhibition and suppression of the expression of *pvl* gene. In addition, it is recommended to optimize the lyophilization of CFS due to its greater stability and versatility. Moreover, using acidic CFS rather than neutralized CFS is encouraged since the pH-lowering effect generated by the production of organic acids correlates with its antimicrobial activity.

Further studies are necessary to determine the concentration, and specific bioactive components and metabolites of the *L. paracasei* CFS that play a role in the down-regulation and growth inhibition of VAG in MRSA. This can be achieved through the use of advanced analytical techniques such as Liquid Chromatography-Mass Spectrophotometry (LC-MS). Future studies may also examine the behavior of CFS in relation to other VAG of MRSA or other microorganisms, for a better understanding of its mechanism.

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# **Experiences of Industry Practitioners in Using SAP Accounting Software in Their Professions: A Phenomenological Study**

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## **KEYWORDS:**

- **Accounting Information System**
- **Cloud Computing**
- **Accounting Process**
- **System Improvement**
- **Perspective**
- **Efficiency**

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**Abstract.** The use of accounting software became prevalent due to its ability to streamline financial processes and increase the accuracy of bookkeeping. This study aimed to understand the experiences of industry practitioners with regards to the utilization of SAP accounting software. The researchers have identified ten participants who satisfied the study's criteria and interviewed them in order to learn more about their

experiences, perceptions of the efficiency of the software and the problems they encountered while using SAP accounting software. The responses gathered were transcribed and

analyzed using thematic analysis, and a total of seven (7) master themes were identified, namely, ease of use, performance optimization, customer support, user satisfaction, internal controls, data security and organization, and system limitations and interface issues. These themes reflected the overall perspective of the industry practitioners with regards to SAP accounting software and the recommendations that they sought for the system to be made better.

# **Experiences of Industry Practitioners in Using SAP Accounting Software in Their Professions: A Phenomenological Study**

## **INTRODUCTION**

The researchers found a significant gap in the knowledge of the lived experiences of industry practitioners with the use of accounting software, specifically SAP accounting software. In a study conducted by Seedwell (2018), accounting graduates were most knowledgeable with communications software skills, word processing, and the utilization of the World Wide Web, but they were lacking in terms of knowledge with accounting packages or software. Puspitawati (2019) also claimed that a person directly using an accounting software could experience difficulty because they do not have sufficient knowledge and educational background, especially in understanding the stages of transaction processing and recording. Thus, the researchers wanted to study the experiences of industry practitioners after they had used the SAP accounting software in their profession in terms of accessing the software, transactions, and customer service. The researchers also wanted to analyze the experiences of industry practitioners on how efficient SAP accounting software was in recording transactions, correcting mistakes, and accessing information pertinent to accounts. In addition, the researchers also wanted to identify the problems that industry practitioners had experienced while using the software.

Technological advancements, especially in the 21st century, have caused developments in various fields and industries all over the world. Even the field of accounting was privy to such changes with the development of various accounting software and the transition from manual bookkeeping and preparation of financial statements to that assisted by computers. Large corporations no longer had to keep their data in physical form; with cloud platforms and digital media, information could now be easily accessed and interpreted (Chai, 2022).

One of the main problems companies face nowadays is the existence of legacy systems (Chew, 2021b), while the introduction and application of Enterprise Application Software (EAS), which is a computer software that was designed to satisfy the needs of an organization as a whole, became one of the most important developments within the accounting industry. This software could be used to support the activities of large organizations, such as human resource management, payroll management, customer support, email marketing systems, and enterprise resource planning (ERP). ERP is a type of software system that helps organizations automate and manage their core business processes to ensure optimal performance (McCue, 2022). They could help coordinate the flow of data between the various business processes of a company and consolidate them into one single database accessible to the necessary people. It is capable of providing the link for the company's financials, supply chain, operations, commerce, reporting, manufacturing, and human resource activities in one platform alone (Microsoft, 2023). One example of the ERP is the Systems, Applications and Products (SAP), which established the global standard for ERP software (Gillis & Essex, 2022). It offers the development of software solutions that would tend to the specific needs of small businesses, midsize companies, and large corporations. The software collects and processes data on one platform and turns raw material purchasing to production and customer satisfaction. SAP solutions could also be used to create forecasts, such as when machine breakdown would most likely occur or the expected revenue for the next period (Choi, 2018). These could be used by enterprises to quickly improve their financial reporting processes to prepare it as efficiently as possible, both in quality and time (Dela Fuente, 2019).

According to Carvel (2022), SAP software allowed different departments within an organization to oversee their respective processes by allowing relevant people to have access to specific information, which helped accelerate work and improvement. SAP was also commonly used for accounting purposes, with Jollibee Food Corporation, San Miguel Corporation, Ayala Land Inc., Bank of the Philippines Islands, and PLDT Inc. availing of its usage within the Philippines alone (Hilao, 2020). The SAP accounting software is also user-friendly and intuitive, has interactive filters to explore reports, automation of various tasks, and assures the accuracy of the information being presented (Calzon, 2022). SAP accounting software provided organizations with a means of managing

business accounts, including journal entries, accounts receivable, credits, tracking cash flow, fixed assets, and monitoring the performance of the business against the budgets that had been set. The software could also be used in the preparation of bank reconciliations, budgeting, closing of accounts, and the preparation and reporting of financial statements (Teoh, 2020).

Accounting information systems, such as SAP, eliminated the need for manual data processing (Balisbis, 2020). The software supported organizations in generating meaningful reports, and assisted in the maintenance of electronic journal books and allowed it to store information. This information was kept from the bookkeeping aspect to the posting to the ledger, reconciliation of accounts, preparation of financial statements, and ending in the closing of temporary accounts. Cloud computing was a new technological trend that brought challenges to computed accounting, such as reduced running costs and unrestricted access to data from anywhere and anytime. Cloud accounting software enables users to have real-time access to business finances, easy set-up and use, access to information from anywhere, work with the sales force, synchronize instantly with the bank, and make tax returns precise and effortless. Security measures such as encryption, access to data, and backups are necessary to ensure proper treatment of accounting data (Singerová, 2018). Patel (2018) said that the accounting activities of businesses became easier by using systems with faster, more accurate, and more timely accounting records and analysis of financial statements. These systems were mechanized with error-free procedures to gather necessary information and data regarding transactions, but they require investment and time to reap the benefits.

Bookkeeping is the act of recording all financial transactions done by the business entity (Schmidt, 2023). It includes the financial record of purchases, sales, receipts, payments, and accruals for payables or receivables. It is an integral part of an accounting information system as it allows users the ability to connect multiple data sources, reconcile entries from various departments, and compile them into a single datasheet. The general ledger contains a record of all the aggregate financial transactions that occurred within a certain period of an entity's operations. The preparation of such document is important as it serves as a master document for all financial transactions. It also helps compile a trial balance, spot unusual transactions, and aid in the preparation of financial

statements (Lutkevich et al., 2022). According to Becraft (2021), account reconciliations are activities performed by accountants that usually occur after the end of an accounting period. This is done to ensure that the general ledger account balance is complete and accurate. These processes were deemed important for accounting professionals to grasp and become familiar with. As claimed by Puspitawati (2019), accounting software can be difficult to use due to lack of knowledge and educational background, especially in transaction processing and recording. Thus, the researchers wanted to conduct this study to be able to understand the experiences of industry practitioners with SAP accounting software. The researchers analyzed these experiences and were able to identify the problems that they had encountered while using the software in their profession, and how they could be mitigated in the future.

The overall objective of this study was to know the experiences of industry practitioners who used SAP accounting software in their profession. The research set out to answer the following questions:

1. What were the experiences of industry practitioners regarding SAP accounting software in terms of:
  - 1.1. Accessing the software
  - 1.2. Transactions
  - 1.3. Customer service
2. What were the experiences of industry practitioners on how efficient SAP is in terms of:
  - 2.1. Recording transactions
  - 2.2. Correcting mistakes
  - 2.3. Accessing information pertaining to accounts
3. What were the problems most encountered by industry practitioners in using SAP accounting software?

This study used an IPO conceptual framework. This research was conducted with the expectation of creating an output with regards to the analysis of the experiences of industry practitioners on their utilization of SAP accounting software. This information was used by the researchers to formulate recommendations for proposed changes in the curriculum of EACC Accountancy students with regards to the related SAP accounting software courses. This was achieved by interviewing a group of industry practitioners who had a) at least 5 years of experience working in any accounting-related profession; b) used SAP accounting software for at least 5 years; and c) received formal training with the said software.



## **METHODOLOGY**

### **Research Design**

The study used a qualitative research design. Qualitative research is a method that explores real-world issues by analyzing participants' experiences, perceptions, and behaviors to generate hypotheses and gain a deeper understanding. This research design was applied to the study by comprehending the intricate human behavior patterns that allowed the research participants to express their thoughts, feelings, and experiences, thereby enhancing the understanding of phenomena that are often challenging to quantify quantitatively.

The researchers used a descriptive phenomenological design. The researchers explored human experiences, questioned biases and preconceived assumptions involving perception, thought, memory, imagination, and emotion, to understand the meaning and presentation of a particular phenomenon. Giorgi's (2009) descriptive phenomenological approach was employed in this study, which was appropriate since the researchers aimed to accurately depict the participants' experiences of the topic they were studying. This design was relevant as the study described the experiences of industry practitioners regarding the use of SAP accounting software in their respective professions.

### **Research Locale**

According to Lombard (2023), SAP is a platform that facilitates smooth departmental collaboration by effectively gathering and processing data from all business activities. Ensuring good data interchange and communication is crucial for companies as it facilitates their endeavors.

Therefore, the study was carried out in the City of Dasmariñas, Cavite, which was home to the industry practitioners who utilized SAP accounting software. The location was chosen by the researchers because it offers a varied group of industry practitioners who work for various firms and with multiple software versions.

### **Research Participants**

For phenomenological research, Creswell advised a minimum of five (5) respondents, whereas Morse proposed a minimum of six (6) study participants. The research participants of this study were ten (10) industry practitioners who had used SAP accounting

software in their profession for at least five (5) years, had been trained for the utilization of the said accounting software, and held a position related to accounting in any capacity during the study.

### **Sampling Technique**

The researchers used a purposive sampling technique for selecting the participants in this study. This was to ensure that only industry practitioners who had utilized SAP accounting software for at least five years, had been trained for the application, and held a position related to accounting were chosen as participants in the interview. In relation to this, the study also used snowball sampling, as the researchers relied on the connections of the participants to be able to get in contact with more industry practitioners. Then, quota sampling as there were only 10 industry practitioners who were asked to participate in the study.

### **Data Gathering Procedure**

The researchers prepared self-made interview questions out of general questions that answered the objectives of the study. They had reached out to industry practitioners who were willing to participate in the study and had met the qualifications of at least five (5) years, had been trained for the utilization of the said accounting software, and held a position related to accounting in any capacity during the study. Upon confirmation, a letter of consent was provided to ensure that their rights were upheld. Additionally, the confidentiality of the participant's information was protected.

Afterwards, utilizing both audio and video recording at the participants' option, the researchers spoke with ten (10) business professionals individually. The interviews were conducted either personally or via the internet using Google Meet and Zoom, with the participant choosing the mode of communication. Each session lasted around half an hour on average. After being recorded, the videos were transcribed, which allowed for an observation and analysis of the participants' SAP accounting software experiences. Thematic analysis was employed by the researchers to gain insights from the interview results and transcribed data. By transcribing the recorded videos, a comprehensive understanding of the participants' experiences with SAP accounting software was achieved. This approach enabled a thorough observation and analysis of their interactions and perceptions towards the software.

The transcripts were then carefully analyzed by the researchers as they read the responses multiple times each. They then extracted relevant statements from the transcripts they had summarized using summary tables. The researchers employed manual coding to identify the themes that were prevalent on each of the participants' responses. These prevailing themes were then identified and further organized into master themes to provide comprehensive understanding of the data. The researchers conducted cross-referencing to ensure the accuracy and reliability of their analysis. Afterwards, the researchers once again reached out to the research participants to confirm that their responses were interpreted in the manner in which they had intended. Additionally, the researchers also sought feedback from the research panelists to validate their interpretations and conclusions, further enhancing the credibility of their analysis.

### **Research Instrument**

Interview was chosen as the research instrument for this study. An interview is a qualitative research method that gathers primary data by asking individuals about their opinions and experiences about an event, product, or topic, providing detailed information that may not be available through other methods. In determining the industry practitioners' experiences with using SAP accounting software, the researcher developed a series of interview guides that consisted of semi-structured questions. A semi-structured interview is a data collection method that employs open-ended and probing questions to understand participants' responses and the topic of interest.

### **Data Analysis**

The researchers used thematic analysis for this descriptive phenomenological study. Thematic analysis is a qualitative data analysis technique that entails going over a collection of data, such as transcripts from focus groups or in-depth interviews, and looking for patterns in the meaning of the data in order to discover themes. In the process of creating meaning from data, the researchers' subjective experiences are important to the active reflexivity involved in thematic analysis (Delve, 2020). Braun & Clarke (2006) provided a six-step guide on how to analyze the participant's response.

**Step 1: Familiarity with the data** – To find the most crucial information and responses, the researchers had meticulously

listened to the audio tape several times and manually transcribed the participants' responses. After reading the transcribed data several times, the researchers underlined the sentences that, in their opinion, provided the answers to the research questions.

**Step 2: Generate initial codes** – The transcriptions were reviewed several times in order to properly comprehend the respondents' experiences with the phenomena. Each statement was then initially interpreted to learn what the participants' meant with their answers.

**Step 3: Searching for themes** – Following that point, a theme was developed from these statements, which were characterized by its relevance to the study. The researchers had examined each statement carefully and observed that some of them were clearly fitted together into a theme.

**Step 4: Review themes** – After formulating the initial themes of the participant, the researchers reviewed the themes a lot of time to make sure that the theme was really supported by the statement in the table. Necessary adjustments were made to make sure that the sub-themes were not overlapping with each other.

**Step 5: Define themes** – Following the collection and arrangement of the themes, the researchers named each theme that was easy for the readers to understand. A master theme was made, which came from the sub-themes of each participant.

**Step 6: Write-up** – Utilizing these themes, the researchers examined the experiences of industry practitioners with SAP accounting software as a whole. The participants' statements about their experiences were used to understand each theme, and the researchers provided a full, objective explanation of each one.

### **Validity and Reliability**

The research instruments were validated to ensure its reliability and accuracy. This was accomplished by having Mr. Amir Auditor and Dr. Rebecca Miranda, two specialists, evaluate and comment on the instruments. Both specialists are well-versed in the evaluation of research instruments and have a wealth of expertise in the field. Their advice made sure that the instruments were reliable and able to provide accurate data by pointing out any possible weaknesses or opportunities for development. Their experience also gave the validation procedure more credibility.

### **Ethical Consideration**

This study used interviews to gather information on the experiences of industry practitioners with the utilization of SAP accounting software. In line with this, the researchers ensured that the research participants had all the relevant information they needed to give their informed consent for the study. The researchers also gave the participants the option to withdraw from the study when they wish to, and their records and transcripts would not be included in the analysis. Furthermore, the researchers used codes to refer to each participant to assure that the identity of the participants remained confidential and personal information were redacted from the transcripts. The researchers also assured that no harm, fraud, or deception would occur to the participants during the interview.

## **RESULTS**

### **Demographic Profile of Participants**

The demographic profile of the participants involved in this study are shown below as:

Table 1

*Demographic Profile of Participants*

	Yrs. of Work Experience in Acc. Industry	Yrs. of Experience with SAP	Received Formal Training (Y/N)
P1	9 yrs.	9 yrs.	Y
P2	6 yrs.	6 yrs.	Y
P3	5 yrs.	5 yrs.	Y
P4	7 yrs.	5 yrs.	Y
P5	5 yrs.	5 yrs.	Y
P6	10 yrs.	7 yrs.	Y
P7	19 yrs.	15 yrs.	Y
P8	5 yrs.	5 yrs.	Y
P9	5 yrs.	5 yrs.	Y
P10	7 yrs.	7 yrs.	Y

The objectives of this study were to know the industry practitioners' personal experiences when it comes to utilizing SAP

accounting software in their profession, their thoughts on the efficiency of the software, and any possible problems they had encountered during its implementation. Before the researchers administered the questionnaire, they made sure that the participants had at least five (5) years of experience, had been trained for the utilization of the said accounting software, and held a position related to accounting in any capacity during the study. This was done to make sure that the participants were qualified to participate in the study. By establishing these criteria, the researchers sought to obtain feedback from people who were proficient in the system and had practical experience in the field of accounting. This approach assured that the participants' opinions and observations were well-informed and appropriate for evaluating the software's efficiency and identifying any potential issues with implementation.

## Summary Tables

Table 2

Summary Table for Participant No. 1

Convenience	Excerpts	Sources
User-friendly	<p><i>"...I would say na sobrang user friendly ni SAP compared sa ibang systems na natry ko, parang siya yung pinaka user-friendly kase si SAP ano siya eh ahm madaling intindihin yung logic nung kung pano siya nagwowork,..."</i></p> <p><b>Translation:</b> "...I would say that SAP is very user-friendly compared to the other systems that I have tried before, it is the most user-friendly because SAP is, what ahm, it is easy to understand the logic behind the process..."</p>	Page 3, Lines 47-50
Multi-tasking	<p><i>"...may ano kase si SAP, may-may option ka na magbukas ka ng maraming window, unlike Oracle na parang magcoclose ka pa, so pwede kang gumamit ng ano- ng maraming-ng maraming windows at the same time pwede kang mag multi-task,..."</i></p> <p><b>Translation:</b> "... SAP has, it gives you an option to open many windows at the same time, unlike Oracle that you need to close the window, so you can use different windows, you can multitask..."</p>	Page 4, Lines 83-85

Table 2 (continued)

Long-term solutions	<p><i>“...usually ganon yung approach nila to fix things laging— sobrang dalang yung band aid solution, laging ano— laging para hindi na siya mag occur in the future, may babaguhin na sila mismo sa programming, or may babaguhin na sila mismo sa accounts yung mga ganun, para hindi na siya maging recurring.”</i></p> <p><b>Translation:</b> “... that is their usual approach to fix things, it is rare that they propose band-aid solutions, they always ensure that it won’t happen in the future, they would make changes on the programming itself or on the accounts or something else to ensure that it would not be recurring...”</p>	Page 10, Line 200 - 203
System Reliability	Excerpts	Sources
Dependability	<p><i>“...powerful siya kase nga kaya niyang humawak ng large volume of data at ano, mas secured, mas structured and mas safe kase all these years naman parang never pa kong nakaencounter ng nag-nagdown yung system, I mean nag down as in nabura-nawala yung data never, parang yung-yung service provider namin sa SAP yung pinaka-pinag-iistore-han namin ng data ano siya ahh reliable naman, parang oh di pa ako naka experience na nabura, may mga nagsi-system maintenance, nagdodown minsan pero sobrang dalang,...”</i></p> <p><b>Translation:</b> “... it is powerful as it can handle large volumes of data and what, it is more secure, more structured and more safe because all these years that I have used it, I have never experienced the system being down, I mean, down as if the data were erased, never. Like the service provider we have with SAP, the one we use to store data, is reliable and I have never experienced the data being erased, system maintenance, the server goes down sometimes but that is very rare to happen...”</p>	Page 8, Lines 163 - 169

Table 2 (continued)

Human Errors	<i>“...at most na magagawa ni SAP is to set up yung general rules na pwede mong ilagay sa kaniya na para malessen yung error halimbawa kung bawal ka na mag-post sa account na to, ahh kay SAP palang pigilan mo na na-ilog mo na yang account na yun, mga ganun....”</i>	Page 13, Lines 260 – 263
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System Reliability	Excerpts	Sources
	<b>Translation:</b> “... the most that you can do with SAP is to set up the general rules that you can use to reduce errors, for example, you cannot post in this account, just with SAP alone, you can prevent that account from being used by locking it and such...”	
Access Restrictions	<i>“...maraming countries na hawak, pati yun restricted yun so ahh naaccess- limited na yung access dun sa transaction dun sa reports, limited pa yung scope na kaya mo i-access, so hindi mo maaccess talaga lahat, and dito kasi samin meron ding mga nagcocontrol nun, so kung nakita nila na hindi ka - hindi mo sakop yung isang yun, yung isang hinihingi mo, idedecline yung - yung – yung request mong yun, ganun....”</i>  <b>Translation:</b> “... we handle a lot of countries, even the restricted ones can be accessed, the access to the transactions, the reports are limited, the scope that you can access is limited, so you cannot access everything. And here in our company, there are people assigned to control access, so if they saw that you are requesting access to areas that are beyond your scope, they will reject you, like that...”	Page 15 - 16, Lines 318 - 323



Table 2 (continued)

System Limitations	Excerpts	Sources
Technical Limitations	<p><i>"Ahh siguro kung problems, may mga systems limitations din siya na ahh, halimbawa kung ako maisip ko na parang mas maganda yung ganto nalang kesa yung ganto, pero hindi namin magawa kase hindi kaya ni SAP, yun. So ang – ang yun lang ang ano ko kay SAP, hindi lahat kaya niyang gawin (*laughs) na mas may mas madali pa sanang way kaso may hindi kaya gawin ni SAP so hindi namin magawa yun."</i></p> <p><b>Translation:</b> "Ahh, with problems I think, the system also has limitations that ahh, for example, I will think that it would have been better if we do this instead of that, but we cannot do that because SAP cannot execute that. So the problem with SAP is that it cannot do everything, that there may be an easier way to do things but because SAP cannot do it, then we also cannot."</p>	Page 17, Line 348 - 353

## Analysis

The themes identified for the first participant were convenience, system reliability, and system limitations.

The first theme, convenience, referred to how the software enabled the users to use multiple windows, evidence of how user-friendly the software was compared to other software, thereby allowing for easier multi-tasking, and how customer service presented long-term solutions to problems brought to their attention instead of band-aid solutions. The participant claimed that SAP was more user-friendly compared to other systems as it had a straightforward approach and she could easily understand the thought process one had to go through to navigate the system and its interface smoothly. Furthermore, she also described how the system enabled her to multi-task by allowing her to open various windows at the same time and easily switch between them without lag or delay. Lastly, she also expressed that she was satisfied with the customer service that SAP itself provides to its users, such as herself, as all of her queries were addressed properly and proper measures were taken to ensure that such problems would not happen again in the future.

System reliability referred to the dependability of the software system in handling large transactions and how a user had access restrictions on what kind of information they had permission to see and what kind of data they could input, which led to fewer human errors and the reliability of the system. The participant described the system as dependable because it can handle large volumes of data and offer security; she also stated that she had never experienced inconveniences such as the system being down due to maintenance issues. She also clarified that the reason why she believed that the system was secured was due to the fact that access was restricted and was dependent on the position of each user. She expressed that as she got promoted, the scope of her access also increased, providing her with more control and privilege with the system. Furthermore, she also stated that as the user, she had to be more aware of her actions, as the majority of the problems with the data are caused by human error, such as accidentally deleting or modifying important files.

The third theme, system limitations, referred to the limitations of the operation of SAP accounting software. It points out the software's technical limitations for certain transactions. The technical limitations she described pertained to the fact that the system cannot do everything they want it to do. As it was programmed to execute things a certain way, they cannot simply modify it themselves, so they had to work within the constraints and limitations of the system. This may often lead to them having difficulties and experiencing frustrations when they have to carry out tasks that they know could have been done in a different way and be more efficient in the long run.

Table 3

Summary Table for Participant No. 2

Ease of Use	Excerpts	Sources
User-friendly	<p><i>"...kahit sabihin mong hindi ka techie. Nandun pa rin yung ano eh, mas madali siyang i-facili- ano bang term... uhh... utilize?"</i></p> <p><b>Translation:</b> "... even if you say that you are not a techie. There will always be that what, it is easier to, what was the term... uhh... utilize?"</p>	Page 5, Lines 81 – 82
Flexibility	<p><i>"...yung SAP kasi, it generates, it, nandyan na lahat eh. From recording to ano, revision ng reports, diba?"</i></p> <p><b>Translation:</b> "... it is because SAP, it generates, it, it contains everything eh. From recording to what, revision of reports, right?"</p>	Page 1, Lines 18 – 19
Availability	<p><i>"...yung mga mag-aayos kasi, hindi siya palaging ano, available eh."</i></p> <p><b>Translation:</b> "... because the people who would fix such problems, are not always what, they are not always available."</p>	Page 6, Line 114 – 115
Efficiency	Excerpts	Sources
Convenience	<p><i>"...mag-fifill out ka lang ng data tapos automatic na yun mag-gegenerate ng report."</i></p> <p><b>Translation:</b> "... all you have to do is to fill out the data and it will automatically generate the report."</p>	Page 5, Lines 87 – 88
Verification	<p><i>"So meron silang supervisor na mag-checheck nun, i-verify..."</i></p> <p><b>Translation:</b> "So they have a supervisor assigned to check that, to verify..."</p>	Page 5, Lines 97 – 98
Time Efficiency	<p><i>"... hindi ko na need na bisitahin isa-isa kasi nandun na lahat ng data na need ko."</i></p> <p><b>Translation:</b> "... I no longer need to check every single one because all the data that I need is already in there."</p>	Page 2, Lines 20 – 21

Table 3 (continued)

System Limitations	Excerpts	Sources
System Overload	<p><i>"Nag-ooverload yung system tapos minsan nag- kailangan, it takes an hour siguro bago mo ulit mabisita."</i></p> <p><i>Translation: "The system often experiences system overload when needed, it takes an hour or something before we can access it."</i></p>	Page 6, Lines 102 – 103

### Analysis

For the second participant, there were three (3) themes identified, namely ease of use, efficiency, and system limitations.

The first theme, ease of use, focused on the experiences of industry practitioners in using and navigating the software. The sub-themes that fell under the first theme were user-friendly, flexibility, and availability. User-friendly referred to how simple it was to use the software, even for those with limited computer knowledge. The participant attributed the system as being user-friendly because, as he said, even though one is not technologically inclined, they would still be able to utilize the system and execute the tasks that they need to do with ease. Whereas flexibility pertained to the ability of the system to perform the whole accounting process. The participant claimed that he believes that the system could carry out tasks from the recording of transactions to the generation of financial reports to helping perform audit procedures. Last was availability, which referred to the window of time during which customer service was available. He mentioned that it often takes up to 3 business days before his queries can be answered, which was detrimental to his work productivity and efficiency. He had also mentioned that oftentimes, he would just wait until the system load was minimal before trying to access the system to ensure that he would experience less lag, glitches, or delays.

The second theme, efficiency, pertained to the ability of the software to perform tasks with ease. The sub-themes identified under this theme were convenience, verification, and time efficient. Convenience and time efficient described the system's ability to carry out tasks quickly and easily. He stated that the system was convenient because all he had to do was input certain information and the system itself would generate the reports he needed automatically. This was integral to his work as an auditor because it

allows him to focus on analyzing the pertinent data and information instead of spending the majority of his time manually generating reports. This also relates to how he described the system to be time efficient as according to him, he no longer had to check that every single information presented in the report is correct as the system provides reasonable assurance of its accuracy and reliability. Verification, on the other hand, referred to the presence of a supervisor who confirms accuracy by double-checking the encoded data. He also expressed appreciation for this process as it provides an extra layer of quality control and ensures the accuracy of the reports. As an auditor, this feature helped him a lot as he had reasonable assurance that any mistakes or discrepancies were detected even before the reports reached him.

The third and final theme was system limitations, which referred to the functionality of the system. This included system overload, which described how the software performs slowly when a large number of users are accessing it. The participant described the difficulties he faced when trying to access the system and how it affected the productivity of his work. Furthermore, this was something that he could just circumvent and try to fix on his own so all he could do in the meantime is to leave the system and hope that when he comes back later, the system will be up and running once again.

Table 4  
Summary Table for Participant No. 3

Ease of Use	Excerpts	Sources
User-friendly	<p><i>"Madali lang naman na maintindihan yung mga, yung mga menu niya, yung mga tabs niya, okay naman siya. And sa mga, and sa, for me, this software is very usable naman siya, parang convenient naman siya sa lahat ng, I think, sa lahat ng industry. Kasi yung mga naencounter ko naman, lahat naman kaya ng software."</i></p> <p><b>Translation:</b> "It is very easy to understand its menu, the tabs are alright in my opinion. And on, for me, this software is considerably usable, it's like it is convenient in every, I think, every industry. Because in what I have encountered before, the system can execute everything I needed it to."</p>	Page 2, Lines 30 – 34
Accessible	<p><i>"...kapag software siyempre uhm ,as easily access. Kapag hindi siya basta-basta mawawala sa software, unlike kapag manual, mas ma–, mas madali mong makuha sa software once you have the document number. Once you, uhm, mas organized pati para sa akin. Mas organized pati, mas organized kapag galing sa SAP."</i></p> <p><b>Translation:</b> "... when it comes to the software, of course, uhm, it can be accessed easily. It cannot be easily removed from the software, unlike with manual, you can easily extract from the system as long as you have the document number. Once you, uhm, for me, it is also more organized. It is more organized as well, it is more organized when it is extracted from SAP."</p>	Page 4, Lines 81 – 85
Availability	<p><i>"Kasi last, the last time naexperience ko, parang kailangan nilang, medyo busy din sila or I don't know why, but kailangan mo magpaschedule and hindi siya basta-basta. Ayon,</i></p>	Page 6, Lines

Table 4 (continued)

Ease of Use	Excerpts	Sources
	<p><i>so, siyempre as, kapag nasa ganito kang department kailangan minsan instant diba so ayon, dapat talagang may time-bound yon."</i></p> <p><b>Translation:</b> "Because on the last, the last time I have experienced it, it is like they need, they are also quite a bit busy or I don't know why, but you need to schedule an appointment with them and it is not that simple. So, of course, if you are in this kind of department you may need an instant solution, so it really needs to be time-bound."</p>	124 – 128
System Reliability	Excerpts	Sources
Competence	<p><i>"I think nagagawa naman na nila yung kailangan nilang gawin."</i></p> <p><b>Translation:</b> "I think they were able to execute properly the tasks that they needed to accomplish."</p>	Page 8, Lines 153 – 154
Data Immutability	<p><i>"Kapag nag-input ka ng details or data, hindi siya madaling i-delete or, madali siyang i-revise pero hindi mo siya madedelete. So kung hindi siya marerevise, pwede siyang, kailangan mo talagang i-explain, tama ba."</i></p> <p><b>Translation:</b> "Once you have encoded the details or data within the system, it is not that easy to delete, it is relatively easy to revise but you cannot delete it just like that. So if you cannot revise it, then you have to explain why such a thing happened to correct it."</p>	Page 11, Lines 226 – 228
Coded Transactions	<p><i>"So, for me, ayon, madali lang din naming mag-extract lalo na kung alam mo na talaga yung SAP kasi madami, madami siyang T codes na ginagamit. So kung hindi ka familiar sa T codes na yon, baka, baka yung ginagamit mo yung manual pero may, may mas madali palang extraction."</i></p> <p><b>Translation:</b> "So for me, it is easy to extract from the system especially if you really know SAP because it has many different T codes that we can use. So if you are not familiar with the specific T codes, then maybe,</p>	Page 10, Lines 203 – 206

Table 4 (continued)

	maybe you are doing tasks manually but there could be an easier way of extraction that you do not know."	
Interface Issue	Excerpts	Sources
Outdated Interface	<p><i>"And for the interface, tama ba, how did you find, uhm, madali din naman medyo ano lang medyo paano ko ba sasabihin, medyo ano lang siya. Di ko alam kung tama yung word na primitive as in, ano medyo ano, di pa siya ganong ka-, ka-, yung graphics niya, if that's the right terms, hindi pa ganong ka-updated."</i></p> <p><b>Translation:</b> " And for the interface, is it right, how did you find, uhm, it is easy but is just somewhat, how do I phrase this, it is just quite a bit. I'm not sure if the right word is primitive, as in, it is quite a bit, it is not yet that developed, its graphics, if that is the right term, is not that updated yet."</p>	Page 2, Lines 26 – 29
Data Overload	<p><i>"Dapat ready siya, kasi medyo mabigat din si SAP magbigay ng mga data input, so andon yung processor mo, hindi siya yung mababa lang yung quality or yung memory. Kasi medyo, I mean, you know naman, doon sa accounting medyo malalaki yung mga ano nito, mga files, documents."</i></p> <p><b>Translation:</b> "It should be prepared, because SAP is quite a bit heavy when it produces data input, so your processor should be considered, it should not be of a low quality or memory. Because it is somewhat, I mean, of course you know, in accounting, we have huge volume of files, of documents."</p>	Page 14, Lines 291 – 294

## Analysis

There were three (3) themes identified for the third participant, namely ease of use, system reliability, and interface issue.

The first theme, ease of use, pertained to the experiences of the industry practitioner with the navigation and utilization of the software. The sub-themes discussed included user-friendly, accessible, and availability. The software's user-friendly and accessible sub-themes emphasized its intuitive interface,



straightforward set-up, explicit instructions, and effective processes. The participant commended the system because it was easy to understand and navigate; she also noted that SAP is also compatible with other industries as it can do everything that they can think of. The participant also explained that because the system was primarily cloud-based, they could easily store a huge volume of data without the risk of it being accidentally deleted or physically damaged. The system also had an inherent feature wherein the data were organized and certain document numbers or codes were attached to each upon creation, which the participant also pointed out as one of the advantages of using SAP. The limited customer support sub-theme pertained to the experience of the user with customer support and how they found their response to be lacking in terms of urgency and efficiency. The participant pointed out that customer support was not always available to them and that they needed to schedule fixes to the problems that they had encountered, which was inconvenient and time-consuming.

The second theme was system reliability, which dealt with a system's capacity to consistently carry out its intended tasks without error or failure. Themes included in this were competence, data immutability, and coded transactions. Competence referred to the capacity of the system to carry out its functions accurately and effectively, guaranteeing that every procedure was carried out as intended. The participant pointed out that, based on what she had experienced so far, SAP was able to execute the tasks that she needed to in order to perform her work. Data immutability pertained to the system's capability to maintain the integrity and security of information by preventing unauthorized modifications or deletions. She had noted that even though it was easy to revise transactions or add on to them, it would be very difficult for them to completely delete certain information. This assured her that the information encoded within the system was accurate and reliable, and it also ensured that no unapproved modification had been made that may compromise the completeness of the data. Lastly, the familiarity with coded transactions emphasized the need for the user to be knowledgeable and comfortable with the specific codes used in the system to ensure seamless operation and troubleshooting if the need arises. The participant stated that the user had to be familiar with the codes itself, as it would serve as a powerful tool when it comes to the navigation of the system and the scope of the task that it can execute for them.

The last theme was interface issue, which referred to the challenges that the users may encounter while using the software that are out of their control. The themes under these were outdated interface and data overload. An outdated interface delves into the experience of the practitioner with an interface that was no longer relevant or up-to-date. This theme explored the claims of the participant that even though the system was easy to use, the look of the interface took away from the experience and affected her productivity immensely. Data overload, on the other hand, as the participant pointed out, pertained to the overwhelming amount of data that was being produced by the system, which could often cause delays, lag, or glitches if the processor of the computer that she was using was not compatible or of a lower quality. Furthermore, the participant noted that such problems were often encountered because the reports that were attributed to accounting itself were admittedly heavy and required a significant amount of processing power, regardless of whether SAP was used or if they were generated manually.

Table 5

Summary Table for Participant No. 4

Convenience	Excerpts	Sources
Secured	<p><i>"...siguro ah fifty-fifty siya kasi 'yun nga uhm parang accessible lang siya kapag walang ibang gumagamit pero kapag ikaw naman na, I mean kapag ano naman kapag hawak mo na yung account, accessible naman siya kasi uhm parang ikaw nalang talaga yung ah may... may gamit parang ano walang... makaka -istorbo sa'yo ganon so wala yung makakapag-control na kunyari may papasok isa sa account hindi nila mako-control yung ginagawa mo."</i></p> <p><b>Translation:</b> "...maybe it's fifty-fifty because it's like uhm like it's only accessible when no one's using it but when it's your turn, I mean when you're the one handling the account, it's accessible because uhm it's like you're the only one who... who uses it, it's like no one... no one can disturb you so no one can control like example if someone will enter the account, they will not be able to control what you're doing."</p>	<p>Pages 2 - 3, Lines 40 - 45</p>
Automatic	<p><i>"...madaming mga factors na tinitignan, yung mga accounts, magco-compute ka pa ng mga amount dapat ma-balance mo pero kapag SAP yung gamit mo once na mag lagay ka ng different transactions, automatic na siya nagge-generate ng uhm journal entry so parang male-less nalang yung workload na gagawin mo so ayun."</i></p> <p><b>Translation:</b> "...there are a lot of factors that are looked at, the accounts, you have to compute for the amounts which you have to balance but if you're using SAP, once you put different transactions, it generates the journal entry automatically so the workload you have to do gets lessen so, that. "</p>	<p>Page 5, Lines 92 - 96</p>
Responsive Support Team	<p><i>"...I think okay naman sila eh kasi yung mga problem lang naman namin sa SAP ano sobrang minimal lang kunyari pag nagla-lag</i></p>	<p>Page 6, Lines</p>

Table 5 (continued)

	<p><i>lang siya ganyan, matagal lang siya mag process siguro aabutin ng ten minutes pero kapag may mga reklamo naman na ganun nagagawan namang siya agad ng paraan...</i></p> <p><b>Translation:</b> "...I think they're okay since our only problem with SAP is minimal like when it's lagging, it takes at least ten minutes to process but when there's any complaint like that, it can be resolved immediately..."</p>	<p>112 - 115</p>
Efficiency	Excerpts	Sources
In and Out	<p><i>"...mas madali namin namo-monitor yung mga in and out na stocks namin. So, mas madali namin siyang namo-monitor or nata-track kung ilan ba yung mga stocks na pumasok sa araw na 'to or yung mga lumabas sa araw na 'to and mas madali namin siyang uhm parang nalalagay sa stock card namin or nare-record."</i></p> <p><b>Translation:</b> "... it is much easier for us to monitor the in and out of our stocks. So, it is much easier for us to monitor or track how many stocks came in today or those that went out today and it is much easier for us to put it in our stock card or record it. "</p>	<p>Page 5, Lines 101 – 105</p>
Data Immutability	<p><i>"... 'di ko alam kung naka help ba sila sa pagco-correct nun kasi nga once na na-save mo siya hindi mo na siya pwede ie- ano i-edit so kung ano yung na-save mo ayun na talaga siya so ang bali ang ginagawa nalang namin nag gagawa kami ng another transaction nagre-record kami ng bagong transaction bali ang nangyayari adjustment siya."</i></p> <p><b>Translation:</b> "...I don't know if it helped in correcting it because once you saved it, you cannot uh edit it so whatever you saved, that's really it so what we do is we make another transaction, we record another transaction so what happens is an adjustment."</p>	<p>Page 9, Lines 167 – 171</p>
Coded Transactions	<p><i>"...basta alam mo yung SAP series kung ah number kasi siya eh so bawat transactions na sinave mo ahm meron yung ano meron siyang series na pino-provide yung SAP so</i></p>	<p>Page 12, Lines</p>

Table 5 (continued)

	<p><i>kapag sinearch mo lang siya automatic na yun dun na yung ano kung ano yung origin, kung ano kung saan mo siya pinasok, kung ano yung journal entry niya lahat andun naman na siya lahat so oo, nate-trace naman siya."</i></p> <p><b>Translation:</b> "...as long as you know the SAP series ah because it's numbers so every transactions that you saved ahm there's a...there's a series that is provided by SAP so if you search it, it automatically locates its origin, where you entered it, what's the journal entry is, everything is there already so yes, it can be traced. "</p>	<p>230 - 234</p>
System Limitations	Excerpts	Sources
Specification	<p><i>"...limitation niya lang is yun nga kapag naghahanap ka ng mga documents dapat talaga may monitoring ka kasi once na nilagay mo lang is kunyari one word nung nilagay mo sa remarks, hindi mo talaga siya mafi-find. So dapat buong remarks kumpleto dapat yun..."</i></p> <p><b>Translation:</b> "...its only limitation is when you're searching for documents, you really should have a monitoring because once you entered like for example, once you entered one word in its remarks, you will not be able to find it. So, the entire remarks should be complete."</p>	<p>Page 12, Lines 237 – 240</p>

## Analysis

Convenience, efficiency, and system limitations were the themes for the fourth participant. Convenience was the first theme, referring to the participant's experience with the software's accessibility, transactions, and customer support. This had three sub-themes: secured, automatic, and responsive support team. The first sub-theme, secured, talked about how the participant accessed the software. According to her, multiple employees in their organization could use the same SAP account, but once she became the user, no other employee could access it. She was relieved that no one could edit her work, which gave her a sense of security. Conversely, automatic referred to the software's automated functionality. The participant said that the software made

her life easier because it eliminated the need for her to manually calculate the balance of the transactions she had encoded. Instead, the system could calculate the balance on its own after she had entered all the necessary transactions and information. The responsive support team was the final sub-theme for this. The participant's company provided a customer service who addressed any problems that employees experienced when using the software as fast as possible.

The second theme, efficiency, focused on the software's capacity to quicken and simplify participants' work. The sub-themes of this were in and out, data immutability, and coded transactions. In and out described how the participant's ability to record and monitor the amounts of stocks that entered and exited the system during their time working in the inventory department was facilitated by the software. The practitioner also recalled that they were unable to alter the transactions they had entered into the software, as this was captured in the sub-theme data immutability. In order to reverse her initial entry, the participant needed to submit a new entry for adjustment. Coded transactions were based from the experience of the participant regarding the transaction being inputted in SAP. According to her, transactions were traceable as long as she could remember the corresponding SAP series number of the transactions she had entered.

The system limitation was the final theme of the fourth participant. This theme alluded to the issue the participant ran into when utilizing the software. The participant was limited to tracking transactions that precisely matched the initial remarks they entered, as indicated by the last sub-theme specification.

Table 6

Summary Table for Participant No. 5

Beneficial	Excerpts	Sources
Comprehensive	<p><i>"...it's very easy to use kasi mabilis magpalit ng module actually... tatlong T-codes at the same time pwede siyang buksan... pwede mo kasi ma-set eh what do you want to see... you have the option to expand the report as much as how many details you want to see or ahm make it a summary..."</i></p> <p><b>Translation:</b> "... it's very easy to use because you can switch modules actually, you can actually open up to three T-codes at the same time... you can set what do you want to see... you have the option to expand the report as much as how many details you want to see or ahm make it a summary..."</p>	<p>Pages 3 - 4, Lines 58 – 65</p>
Coded designation	<p><i>"...mas mabilis siya kasi... kumabaga sa chart of accounts may certain assigned codes na for every type of accounts... So the tendency is hindi mo na siya mane-neglect i-record kasi encouraged kana to record it kasi mabilis na lang siya."</i></p> <p><b>Translation:</b> "...because it's much faster... apparently in the chart of accounts, there are certain codes assigned to every type of account... So, the tendency is you won't neglect the recording anymore since you are more encouraged to record because it's faster."</p>	<p>Page 7, Lines 128 - 132</p>
System Reliability	Excerpts	Sources
Dependability	<p><i>"...hindi ako basta-basta makaka input, para din iwas din syempre sa mga, what do you call this...fraudulent actions."</i></p> <p><b>Translation:</b> "...I cannot input right away, it's also to avoid those, what do you call this...fraudulent actions."</p>	<p>Page 4, Lines 83 - 85</p>
Verification	<p><i>"...may next level checking pa, may next level ahm, ahh what do you call this, parang</i></p>	<p>Page 13,</p>

Table 6 (continued)

	<p><i>authorization or I forgot, it's not the right word, I can't find the right word, parang... verification, may verification pa so to fabricate that I think it would really take a team to do that..."</i></p> <p><b>Translation:</b> "...there's also a next level checking, there's a next level ahm ahh what do you call this, it's like an authorization or I forgot, it's not the right word, I can't find the right word, it's like... verification, there's a verification so to fabricate that I think it would really take a team to do that..."</p>	<p>Lines 262 - 265</p>
Time Efficient	<p><i>"...you just have to input ano yung gusto mo makita...so that's where you generate all the transactions, kahit ano pang ledger yan, so you just input there ahh kasi pwede rin siyang ano eh from what number to this number, so pwede mo ng sakupin lahat ng codes ng nasa chart of accounts mo, and then generate it... and then lalabas lahat ng transactions and then you can just summarize that..."</i></p> <p><b>Translation:</b> "...you just have to input whatever it is you want to see... so that's where you generate all the transactions, whatever ledger it is, so you just input there ahh because it can be also from what number to this number so you can cover all the codes that are in the chart of accounts and then generate it... then all transactions will come out and then you can just summarize that..."</p>	<p>Page 14, Lines 285 – 291</p>
System Limitations	Excerpts	Sources
Technical Limitations	<p><i>"...nagkakaroon lang ako ng problem kapag nagkakaroon ng internet connection problem..."</i></p> <p><b>Translation:</b> "...I only encounter problems when there's an internet connection problem..."</p>	<p>Page 2, Line 33 - 34</p>
Specification	<p><i>"...for me it's a problem kapag ka meron ako kailangan tapos wala na pala ako access sa T-Code na yun, kumbaga higher level na pala yung naka access nun..."</i></p>	<p>Page 16, Lines 333 - 335</p>



Table 6 (continued)

<p><b>Translation:</b> "...for me it's a problem when I need something but I don't have any access to that T-Code anymore, like someone from a higher level only could access it..."</p>
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## **Analysis**

Themes that emerged from the participant's response analysis included beneficial, system reliability, and system limitations.

The first theme, beneficial, dealt with the participant's perception of the software. This had three sub-themes: comprehensive, code designation, and responsive support team. According to the participant, SAP was the first program she used when she first started working. It allowed her to open numerous tabs and work on them concurrently, which greatly eased her life and increased her productivity. She was really encouraged that there were defined codes for each type of transaction, making it impossible to neglect the recording of transactions. Having an issue with the program was not too big of a deal because there were plenty of knowledgeable people who could fix it right away.

The effective internal control of the program was mentioned in relation to the second theme, system reliability. The participant said that in order to prevent fraudulent activities, an employee cannot just enter anything into the software; instead, any transactions recorded by a junior accountant need to be verified by a higher-ranking employee. She further disclosed that in order for an employee to access certain codes, authorization from a higher authority was required. SAP was a dependable program because it only allowed access to those who justify their needs to utilize it.

Technical restrictions and specifications were sub-themes of the final theme, system limitations. These were the problems that the participant encountered when utilizing the program. The SAP program required an internet connection to function, therefore any issues with this caused delays in the job that must be done. A further issue that the participant had was that she was unable to access certain codes when she needed them because a higher-level employee had the access to it already.

Table 7

Summary Table for Participant No. 6

Ease of Use	Excerpts	Sources
User-friendly	<p><i>"Hmm, user-friendly. Madali lang siyang gamitin tapos madali din naman kabisahin yung mga codes na kailangan mo specific sa kailangan mong gawin, checking ng inventory, ng open orders, tsaka uhm kung bayad na yung orders yun."</i></p> <p><b>Translation:</b> "...Hmm, user-friendly. It's easy to use and the codes you need for specific transactions can be memorized easily, for checking of inventory, open orders, then uhm if those orders are already paid."</p>	Page 2, Lines 27 – 29
Access Restriction	<p><i>"Pero ang galing din naman kasi if hindi ka part ng finance, hindi ka rin makakapasok doon sa mga T-Codes na ginagamit nila or kahit sa mismong kasi when you log-in sa SAP mamimili ka eh finance, planning tas marami pang iba. Hindi ka makakapasok sa finance mismo na screen so yun okay yun kasi secured yun, secured yung sa finance."</i></p> <p><b>Translation:</b> 'But it's really amazing that if you're not part of finance, you will not be able to access the T-Codes that they are using or even in the... because when you log-in in SAP you will choose whether finance, planning, then there's a lot more. You won't be able to access the finance so that's okay since it's secured, the finance is secured.'</p>	Page 4, Lines 65 – 69
Responsive Support Team	<p><i>"Hmm, una magra-raise ka ng ticket through email after non pag may ticket ka na na-receive uhm kapag urgent or priority 1 agad yung issue mo, nagche-check na sila sa Teams para ma-remote na nila yung PC."</i></p> <p><b>Translation:</b> "Hmm first, you have to raise a ticket through email then after that, when you received a ticket already, if your issue is urgent or priority 1, they will immediately check the Teams so they can remote the PC already."</p>	Page 9, Lines 161 – 163

Table 7 (continued)

Operational Efficiency	Excerpts	Sources
Automation	<p><i>"...mahirap yun kasi sa dami ng data, sa dami ng nire-release ng mga— na purchase order hindi pwedeng naka-excel file lang yun tapos ima-manual mo an ah okay na to delivered na to, imamanual mo na ganon hindi kasi pag sa SAP ilagay mo lang yung purchase order na number makikita mo na yung status, automatic siyang uhm nakikita na closed na, delivered na kaya big help yun kaysa manual mo siyang ico-consolidate at imo-monitor sa isang file."</i></p> <p><b>Translation:</b> "...it's hard because there is a lot of data, in the large amount of purchase orders being released, excel alone and doing it manually to say that it's okay, it's delivered already is not suitable for it. Because when you put it in SAP, you just enter the purchase order number, then you'll see its status, it automatically appears if it's closed already, or delivered, that's why it's really a big help instead of consolidating it manually and monitoring it in one file."</p>	Page 6, Lines 114 – 119
Version Control	<p><i>"Oh! Feeling ko hindi kasi nakikita yun lahat eh lahat ng changes mo so kung gagamitin siya sa ganon mai-investigate pa din na ay teka ito oh minanual change mo siya so I don't think possible siya, may record ang lahat ganon ng gawa mo."</i></p> <p><b>Translation:</b> "Oh! I think no because everything can be seen, every change you've made so if you'll use it for that, then it would still be investigated like look, this was manually changed so I don't think it's possible, there are records for everything you did."</p>	Page 10, Lines 198 – 200
Efficient Data Management	<p><i>"Efficient talaga gumamit ng SAP kasi sabi ko nga kanina parang lahat ng details nandun, hindi mo na kailangan kumontact ng ibang tao para makita mo yung mga nangyari sa order mo kasi nandun na lahat. So, isang tingin mo lang sa screen, lalo na kung may concern yung customer sayo or yung vendor sayo, alam mo na agad isasagot"</i></p>	Page 9, Lines 170 –

Table 7 (continued)

Operational Efficiency	Excerpts	Sources
	<p><i>kasi andun na sa SAP lahat so okay siya."</i></p> <p><b>Translation:</b> "...Using SAP is very efficient because like I said earlier, almost all the details are already there, you don't have to contact other people to see what happened with your order because everything is there. Just one look on the screen, especially if a customer has a concern or the vendor, you'll know what to say since everything is in SAP already so it is okay."</p>	174
Interface Issue	Excerpts	Sources
Outdated Interface	<p><i>"Hmm, hindi naman. Maliliit lang siya tas mga ano ba... wala siyang... kailangan mong itutok yung mouse mo para malaman kung ano yung button na yun kasi walang name.. mga ano lang siya... yung para dito sa kunyari sa gmeet diba makikita mo lang mic ganyan (clicking sounds) pero dun kasi may mga uhm execute diba pag di ka gagamit ng keyboard kung ie-enter mo hindi mo alam na yun yung enter dun kapag kinlick mo kailangan mo siya aralin, yun."</i></p> <p><b>Translation:</b> "Hmm, not really. It's just really tiny then...it has no...you have to focus the mouse to know what button is it since it has no name... it's just...for example here in gmeet you can just see the mic (clicking sounds) but in there, there are uhm execute right, if you won't use the keyboard, if you don't know where is the enter, you won't know that that is the enter when you click it, you have to study it."</p>	Page 3, Lines 43 – 48
Technical Limitations	<p><i>"...meron kasi sa first screen makikita mo kailan yung delivery date pero meron kang papasukan sa SAP para makita mo yung mga tracking numbers, yung ibang details ng shipment. Sa first page, makikita mo kunyari ano ba ngayon October— ah kunwari September 30 na-deliver, ayun makikita mo</i></p>	Pages 9 – 10, Lines 179 – 184

Table 7 (continued)

<p><i>sa first screen pero pag pumasok ka dun sa detailed na na shipment, August pa pala siya na-deliver yung ganon."</i></p> <p><b>Translation:</b> "...because on the first screen, you will see the delivery date but in SAP you have to access something first to see the tracking numbers, the details of the shipment. In the first page, you'll see for example what date it is today October— ah for example, it was delivered on September 30, you will be able to see that on the first screen but when you accessed the much-detailed shipment, it was indicated there that it was delivered already in August, something like that."</p>
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## Analysis

There were three (3) themes identified for the sixth participant, which included ease of use, operational efficiency, and interface issue.

The overall experience and satisfaction of the participant were summed up on the first theme, ease of use. The sub-themes that emerged from the participant's statements were user-friendly, access restriction, and responsive support team. The practitioner described SAP as a user-friendly software as its codes were not complicated and could be easily memorized. On the other hand, access restriction pertained to the security that the software had given the participant as she mentioned that it had security measures to control the access of certain features and information, ensuring privacy, and protecting sensitive data. The last sub-theme referred to the experience of the practitioner with regards to providing timely and effective customer support that addressed any issues or concerns raised by users promptly and efficiently.

Operational efficiency as the second theme talked about streamlining processes and maximizing productivity in order to achieve optimal results. This theme focused on identifying areas for improvement, eliminating unnecessary steps, and implementing effective strategies to enhance efficiency across all operational aspects. Automation, version control, and efficient data management were the sub-themes of this theme. As the participant worked in the supply chain department, SAP's automated function helped her monitor the status of the purchase orders they managed. The participant brought up SAP's capability to monitor software

modifications and identify individuals responsible for them. She was reassured by this that no one would create fraudulent transactions in the software. Additionally, she stated that the system could automatically extract data with little effort, which was also related to how well the data was organized and managed within the system.

Interface issue was the final theme for this as it focused on issues that the participant had encountered while using the software. The sub-themes, outdated interface and technical limitations, were identified after analyzing the participant's statement. Design problems were a reflection of the difficulties the user had faced as a result of the software's own layout and design. The participant also mentioned that she had problems when navigating the software as most of the icons were either small, misleading, or lacked labels, which made it difficult to understand. On the other hand, a system glitch refers to any technical issues or mistakes in the software that the participant mentioned, making it more difficult for the user to utilize and read information correctly.

Table 8

Summary Table for Participant No. 7

Ease of Use	Excerpts	Sources
User-friendly	<p><i>"My experience with accessing SAP is okay naman and I did not experience any problem while using it so far. Yung user interface SAP, ng SAP, is intuitive and easy to navigate. Additionally, impressive din yung responsiveness ng system, nake-carry out ko ang tasks ko ng walang delays."</i></p> <p><b>Translation:</b> "My experience with accessing SAP is okay and I did not experience any problem while using it so far. The user interface SAP, of SAP, is intuitive and easy to navigate. Additionally, the responsiveness of the system is also impressive, I can carry out my tasks without delays."</p>	Page 2, Lines 20 – 23
Complete Accounting Cycle	<p><i>"In our company, end to end accounting process yung ginagawa sa SAP. So starting sa journalizing hanggang financial reporting, sa SAP yon lahat. Madali naman yon siya, madali naman siyang gawin sa software saka</i></p>	Page 3, Lines 57 – 60

Table 8 (continued)

	<p><i>kita mo lahat agad yung mga data na kailangan.</i></p> <p><b>Translation:</b> "In our company, what's done in SAP is an end to end accounting process. So starting from journaling to financial reporting, it's all in SAP. Those are easy, it's easy to do in the software, and you can see all the data you need right away."</p>	
Responsive Support Team	<p><i>"May L1/L2 support provided yung SAP sa company namin. It's like a ticketing system, yung L1 support handles yung mga basic troubleshooting and issue resolution. Then yung L2 support para sa mga more complex problems na required yung mas intense na investigation and such. So based sa, based on the level of your problem, they are able to help you in any ways. In my experience, mabilis naman maresolve yung issue kapag L1 pero kapag escalated na siya sa L2, medyo matagal kasi siya ini-investigate."</i></p> <p><b>Translation:</b> "SAP has L1/L2 support provided in our company. It's like a ticketing system, the L1 support handles basic troubleshooting and issue resolution. Then the L2 support is for more complex problems that require more intense investigation and such. So based on, based on the level of your problem, they are able to help you in any ways. In my experience, the issue can be resolved quickly if it's L1, but when it escalates to L2, it takes quite a while to investigate it."</p>	Page 5, Lines 88 – 94
System Reliability	Excerpts	Sources
Intuitive System	<p><i>"I have fairly positive experience sa SAP uhm, pagdating sa recording ng mga transaction. User-friendly nga yung software kaya madaling mag-input ng data sa magna—, mag navigate. May error-checking features din siya na finafalg din kami kapag may nadetect na inconsistencies sa mga recorded data."</i></p> <p><b>Translation:</b> "I have fairly positive experience with SAP uhm, when it comes to recording transactions. The software is user-friendly so</p>	Page 6, Lines 121 – 124

Table 8 (continued)

<p><i>it's easy to input data into the navi-, to navigate. It also has error-checking features that we get flagged for when inconsistencies are detected in the recorded data."</i></p>		
System Reliability	Excerpts	Sources
Data Checking	<p><i>"Mahalaga na accurate and tama yung ilalagay namin na data sa system kasi yung din yung ilalabas samin. So kung mali ka, mali din yung software. Kaya dapat, may double-checking and verifying ng information bago input. Hindi na yon fault ng software, nasa tao na yon na na nagamit."</i></p> <p><b>Translation:</b> "It is important that the data we enter into the system is accurate and correct because it is also the data that will be released to us. So if you are wrong, the software will also be wrong. So there should be double-checking and verifying of information before input. It's not the software's fault anymore, it's on the person who used it."</p>	Page 7, Lines 135 – 139
Input – Output Principle	<p><i>"Si SAP kasi pinapakita lang niya kung ano yung programmed sa kaniya. To be recorded or exported, nothing else. This means na any transactions or data na hindi specifically included sa programming will not be displayed or hindi mo din makikita. Kaya dapat, lahat ng data na need mo, nasa system dapat, Parang ano lang yan, you cannot give what you do not, what you do not have."</i></p> <p><b>Translation:</b> "SAP only shows what is programmed to it. To be recorded or exported, nothing else. This means that any transactions or data that are not specifically included in the programming will not be displayed or you won't see it either. So all the data you need should be in the system. It's like this, you cannot give what you do not, what you do not have."</p>	Page 9, Lines 169 – 173
Interface Issue	Excerpts	Sources
Iterative Design	<p><i>"...but I believe na, that there is always room for continuous improvement para maenhance pa yung user experience and maging updated pa rin siya. I think, they should incorporate yung</i></p>	Page 2, Lines 37 – 41



Table 8 (continued)

	<p><i>mga user feedback sa mga changes na gagawin nila para fit siya sa user needs and preferences."</i></p> <p><b>Translation:</b> "...but I believe that, that there is always room for continuous improvement to still enhance user experience and still be updated. I think they should incorporate the user feedback in the changes they will make to fit the user needs and preferences."</p>	
Human Error	<p><i>"Afterall, tao pa rin yung nag-input ng data kaya baka may mistakes once in a while and hindi siya mapick up ng system."</i></p> <p><b>Translation:</b> "After all, it's still a human who inputs the data, so there might be mistakes once in a while and it won't be detected by the system."</p>	<p>Page 9, Lines 178 – 180</p>

## Analysis

There were three (3) themes identified for this participant, which were ease of use, system reliability, and interface issue.

The ease of use theme explored the sub-themes of user-friendly, complete accounting cycle, and responsive support team. These sub-themes were vital in providing the user with a positive experience when using the accounting software. The participant claimed that SAP had user-friendly features that made it possible for users to easily navigate and operate the program. They can also do the complete accounting cycle in the software, starting from journalizing entries up until financial reporting, which guarantees that all important procedures are covered. Furthermore, in order to rapidly and effectively handle any user complaints or difficulties, SAP provided them with L1 and L2 support, with L1 support handling the basic troubleshooting and issue resolution and L2 support handling the more complex problems that require more intense investigation.

The second theme of system reliability pertained to the sub-themes of intuitive system, data checking, and the input-output principle. The theme emphasized the importance of security and the protection of sensitive information. It included the intuitive system sub-theme, which used user-friendly interface that allowed for easy

navigation and has error-checking features to detect inconsistencies in the data; data checking, which pertained to the participant doing thorough validation and verification processes to detect errors that would be inputted in the system; and the input-output principle sub-theme, in which the participant only sees information based on actual input entered in the system.

The last theme identified was interface issue, which comprised the sub-themes of iterative design and human error. Iterative design is a continuous process of refining and improving a product through testing and feedback, aiming to enhance usability and the user experience. It involves gathering user input and making changes to improve usability. This referred to the participant's belief that there is always room for improvement to enhance the user experience and that she thinks that SAP should incorporate user feedback when updating the system to fit the user's needs and preferences. Another limitation of the software was detecting human error. It referred to mistakes or incorrect actions made by individuals during product use, affecting usability and effectiveness. The participant said that as it was still a human who inputs the data, errors ranging from simple to complex cognitive errors had a possibility of not getting detected as the system had no way of picking up the wrong inputted data.

Table 9

*Summary Table for Participant No. 8*

Ease of Use	Excerpts	Sources
Familiarity	<p><i>"Mahirap siya i-access at first since ano, masyadong magulo and maraming tools na dapat tignan..."</i></p> <p><b>Translation:</b> "It is difficult to access at first since what, it is too messy and there are many tools to look at..."</p>	Page 2, Lines 27 – 28
Flexibility	<p><i>"...na-iimprove niya rin yung flexibility kasi, kasi nag-ooffer siya ng wide range of modules eh."</i></p> <p><b>Translation:</b> "...it also improves the flexibility because, because it offers a wide range of modules eh."</p>	Page 3, Lines 75 – 76

Table 9 (continued)

Availability	<p><i>"...kasi nag-try ako tumawag sa customer service nila pero, uhm, hindi sila nag-rireach out agad and ang tagal nila mag-reply..."</i></p> <p><b>Translation:</b> "...because I tried to call their customer service but, uhm, they didn't reach out right away and they took a long time to reply..."</p>	Page 4, Lines 92 – 93
Efficiency	Excerpts	Sources
Convenience	<p><i>"...good siya kasi ano eh, mabilis nalang siya. I mean yung software na mismo yung nag-aasikaso nun. As in, makikita mo nalang, ah okay ito na pala yung nangyari..."</i></p> <p><b>Translation:</b> "...it's good because its, because let's just say it's fast. I mean the software itself takes care of that. As in, you'll see, ah okay, this is what happened..."</p>	Page 6, Lines 134 – 136
Human Error	<p><i>"...so I decided to ano, solve it manually. Inulit ko nalang talaga ulit."</i></p> <p><b>Translation:</b> "...so I decided to what, solve it manually. I really just repeated it again."</p>	Page 4, Lines 93 – 94
Access Restrictions	<p><i>"...kapag ako nagawa tapos pina-pass ko sa ano, nakikita ko naman kung kanino ko napapasa tapos kung sino yung nag-eedit and nagdadagdag kaya I think traceable naman siya..."</i></p> <p><b>Translation:</b> "...when I'm working and then I pass it to what, I can see who I'm passing it to and then who's editing and adding something so I think it's traceable..."</p>	Page 8, Lines 188 – 190
System Limitations	Excerpts	Sources
Technical Limitations	<p><i>"...nag-import or nag-journal ako ng mga transaction, sometimes nagbabago din yung value niya tas sometimes kapag nilalagay ko siya underneath, nawawala."</i></p> <p><b>Translation:</b> "...I import or journal transactions, sometimes the value changes, and sometimes when I put it underneath, it disappears."</p>	Page 5, Lines 123 – 125

## **Analysis**

The three themes identified for the eighth participant were ease of use, efficiency, and system limitations.

The first theme, ease of use, focused on the industry practitioner's experience with customer service and the utilization of SAP accounting software. There were three sub-themes that fall under this theme, namely familiarity, flexibility, and availability. Familiarity referred to the experience of the participant in accessing the software for the first time. She stated that the software was too messy and had an overwhelming number of tools available, which added to the difficulty of navigating the software for first-time users. On the other hand, flexibility referred to the participant's experience in performing her tasks as the software offered a wide range of modules that allowed them to do many tasks, whereas availability indicated how long it takes for the customer support to address system issues and reach out to the participant.

The second theme was efficiency, which pertained to the overall performance of the software. Under this theme, there were three sub-themes identified: convenience, human error, and access restrictions. Convenience described the system's capacity to carry out operations quickly and automatically connect relevant transactions, such as purchase orders and payment for that specific purchase order. Human error referred to the participant's experience of manually redoing the wrong data entered in the system when someone changed what they inputted, as they were unable to contact customer service. Access restrictions described the software not having the appropriate restriction for accessing data when someone changes what the participant entered in the system. The third and final theme was system limitations, which referred to technical issues in the software. Under this theme were the technical limitations, which pertained to the system issues that sometimes made the transactions the participant imported or journalized change value. In cases where they reached the last part of encoding data and scroll to the top of the data, it turned out that the data above was lost, and after she did it again, the data at the bottom would also go missing.

Table 10

Summary Table for Participant No. 9

Ease of Use	Excerpts	Sources
Practicability	<p><i>"...kahit anong device yung gamit, ay hindi, syempre laptop pala na device or kahit anong laptop device gamit, na-aaccess namin yung pag-input-input dun na kung ano yung pinapagawa sa'ming activity ganun. Di siya limited sa isang device lang."</i></p> <p><b>Translation:</b> "...whatever device used, ah no, of course laptop device or any laptop device used, we can access the inputs there in the activity tasked to us. It is not limited to one device only."</p>	Pages 2 – 3, Lines 42 – 45
Flexibility	<p><i>"...siguro meron din siyang ganun na feature kasi marami siyang mga pindot-pindot pagka ni-right click, madaming lumalabas..."</i></p> <p><b>Translation:</b> "...maybe there is also a feature like that because there are many buttons and when you click right, there are many pop-ups..."</p>	Page 4, Lines 68 – 69
Availability	<p><i>"Pagka hindi mo alam kung sino yung parang pinaka-in charge when it comes to dun sa mga link na ginagamit or yung dun sa software, hindi mo alam saan ka makikipag-coordinate..."</i></p> <p><b>Translation:</b> "When you do not know who the person in charge is when it comes to the links used or the software, you will not know who to coordinate with..."</p>	Page 5, Lines 102 – 104
Efficiency	Excerpts	Sources
Time Efficiency	<p><i>"...unang-una yung ano, mas mabilis na nagagawa yung bagay-bagay..."</i></p> <p><b>Translation:</b> "...first is the, things are done quicker..."</p>	Page 4, Lines 75 – 76
Intuitive System	<p><i>"...yung sa pag sa date tas mali yung nalagay tas biglang mag-rered naman yun, mag-wawarning naman si SAP... hindi siya mag-iinput pag mali yung date..."</i></p>	Page 7, Lines
Efficiency	Excerpts	Sources
Intuitive System	<p><b>Translation:</b> "...on the date then the input is wrong it will turn red, SAP will give out a</p>	133 – 137

Table 10 (continued)

	warning... it will not be inputted if the date is wrong..."	
Data Immutability	<p><i>"Dahil nga dun sa relationship map, easily mong makikita, ma-tatrack mo na 218gada no yung source document nung pinanggalingan nung order..."</i></p> <p><b>Translation:</b> "Because of the relationship map, you can easily see, you can immediately trace the source document where the order came from..."</p>	Page 4, Lines 77 – 79
System Limitations	Excerpts	Sources
Technical Limitations	<p><i>"...kailangan ng internet parang ma-access yung site, kapag mabagal internet, ayun din babagal din yung pag-load nung kung may ini-input ka ganun, pero di naman ganun kung may stable internet ka naman."</i></p> <p><b>Translation:</b> "...internet is needed to access the site, if the internet is slow, the loading time when you input something will also slow down, but it will not be like that if you have a stable internet."</p>	Pages 9 – 10, Lines 192 – 195

## Analysis

The three themes identified for the ninth participant were ease of use, efficiency, and system limitations.

For the first theme, ease of use, which dealt with the utilization of the software, three sub-themes had been determined, namely practicality, flexibility, and availability. Practicality referred to the software's ease of access since the participant was able to utilize the system using any laptop device and without the need to download it, whereas flexibility was the system's capacity to do various tasks through its various features. On the other hand, availability was the person in charge of technical matters, which required their presence to resolve. The participant elaborated how hard it was when the user does not know who to contact when encountering issues, which could hinder them from finishing their tasks on time.

Efficiency, which relates to system performance, was the second theme that was identified. Under this theme were the three sub-themes: time efficient, intuitive system, and data immutability.

Time efficient was the ability of the software to perform transactions promptly, whereas intuitive system pertained to the existence of a relationship map that made it simple to trace records. The participant shared her experience with doing tasks. Through SAP accounting software, she was able to do tasks quicker since there was no need for doing things manually and with the presence of the relationship map, the participant was able to see the connection of each data easily. Last was data immutability, which referred to the software feature that alerts users to input errors. When there were data inconsistencies on a user's input, the system would notify the user and would not allow the data to be encoded. The third and final theme was system limitations, which referred to the time it takes the system to process data. Under this is internet reliance, which pertained to the need for a stable internet connection to load information with ease. The time for data processing was dependent on the strength of the user's internet connection.

Table 11

Summary Table for Participant No. 10

Beneficial	Excerpts	Sources
Familiarity	<p><i>"accessible naman siya kung alam mo yung ginagawa mo...if you have no basic knowledge about accounting, it will be very difficult na gamitin siya, kumbaga user-friendly siya for certain demographics, and... need na may knowledge ka talaga."</i></p> <p><b>Translation:</b> "it is accessible if you know what you are doing...if you have no basic knowledge about accounting, it will be very difficult to use, like it is user-friendly for certain demographics, and... you really need to have knowledge."</p>	Page 3, Lines 41 – 43

Table 11 (continued)

Beneficial	Excerpts	Sources
Global Collaborati on	<p><i>“...kahit nasa ibang bansa sila tapos kami dito sa Pilipinas, pareho lang kami nakikita na mga data in real time, so parang we were very close with one another. Naisip ko nun, ang galing naman nito, international yung other team members namin, pero local yung dating kapag collaboration dahil sa software.”</i></p> <p><b>Translation:</b> “...even if they are in other countries then we are here in the Philippines, we see the same data in real time, so like we were very close with one another. I thought before, this is amazing, our other team members are international, but the collaboration seems local because of the software.”</p>	Page 4 - 5, Lines 82 – 85
Responsive Support Team	<p><i>“...nag-eemail din sila samin ng report na pinaka-summary ng steps na ahh ginawa nila to address the issue, nakalagay din dun yung mga steps for the future in case ganun... we can try to... troubleshoot it on our own para mas mabilis yung process.”</i></p> <p><b>Translation:</b> “...they email us reports on the summary of steps that they did this to address the issue, it also includes the steps for the future in case that... we can try to... troubleshoot it on our own to fasten the process.”</p>	Page 6, Lines 106 - 110
Efficiency	Excerpts	Sources
Competence	<p><i>“...highly efficient siya sa pag-capture accurately ng mga data and kaya niya magstore ng... huge sizes of data... kaya niya magprocess ng data and mag-generate ng report na proven to be accurate in a very short time frame, so bukod sa nakakasave siya ng time, less na din yung mga errors or mga... discrepancies.”</i></p> <p><b>Translation:</b> “...it is highly efficient when it comes to capture data accurately and it can store... huge sizes of data... it can process data and generate report that are proven to be accurate in a very short time frame, so aside from saving time, errors or discrepancies are lessened.”</p>	Page 7, Lines 127 – 132
Human Error	<p><i>“...minsan kapag... mag-iinput ka ng info tapos mali pala yung code like sa business partner... ganiyan sa purchasing ng inventory,</i></p>	Page 8, Lines 145 – 148



Table 11 (continued)

	<p><i>hindi ka niya papayagan, may red na lalabas sa baba na error business partner not found so mafa-flag siya...</i></p> <p><b>Translation:</b> "...sometimes when... you input info the the code like in the business partner is wrong, like that in purchasing inventory, it will not allow you, a red error business partner not found will pop up below so it will be flagged..."</p>	
Access Restrictions	<p><i>"As napo-promote ka, saka lang nadadagdagang yung access mo..."</i></p> <p><b>Translation:</b> "As you get promoted, only then your access expands."</p>	Page 3, Lines 52 - 53
Interface Issue	Excerpts	Sources
Old-fashioned	<p><i>"Bukod sa i-update nila sana yung interface nila to be more modern, wala naman akong problema."</i></p> <p><b>Translation:</b> "Aside from updating the interface to be more modern, I have no other problems."</p>	Page 10, Lines 200 - 201
Outdated Interface	<p><i>"...medyo outdated or basic lang yung itsura niya..."</i></p> <p><b>Translation:</b> "...it is quite outdated or its appearance is basic..."</p>	Page 2, Line 33

## Analysis

Based on the responses of the tenth participant, three themes surfaced: beneficial, efficiency, and interface issue.

The first theme, beneficial, stated that while using the program was undoubtedly easier for everyone, it would be far more advantageous to have some prior knowledge of what you are doing and having basic background knowledge on the software would make it easier for the user to navigate it. The participant also shared how the software enabled her to collaborate with people from other countries. Through SAP accounting software, the participant and her teammates from different places were able to see the same data in real time. Another great experience the participant had experienced with the software relates to how responsive its customer service was. Included in the customer service report were the steps on how they addressed the issue so that the users would be able to try solving the problem on their own the next time they experience it.

On the other side, efficiency explained how the software was able to process massive amounts of data without crashing. With the help of the software, the participant was able to generate accurate reports since the system was highly efficient in capturing data accurately. The participant also expressed her satisfaction with regards to the security of the system. Since there was an authorization feature, what a user could see was limited to her role. Another feature that was helpful for the participant was its alerting feature. When entering data with inconsistencies, the system would notify the user and would not allow them to input the data. The participant's distaste for the software was explained in the final theme, interface issue. The participant stated that the system had an outdated visual interface and given that we live in a digital age, one would anticipate accounting software to have a more visually appealing interface.

## **Master Theme**

Following the presentation of the Summary Table, the recurring themes for each participant were identified and attributed together in order to create a Superordinate Theme. These themes sum up the lived experiences of the participants with regards to SAP accounting software. The Superordinate Theme offers a comprehensive overview of the participants' experiences and insights on SAP accounting software, revealing common patterns and perspectives from their individual accounts.

Table 12

Master Theme No. 1 Ease of Use

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
<b>User-friendly</b>	"...sobrang user friendly..."	"...kahit sabihin mong hindi ka techie."	"...very usable naman..."		"...It is very easy to use..."	"Madali lang siyang gamitin..."	"...intuitive and easy to navigate."		"...Di siya limited..."	
<b>Secured</b>	"...mas safe..."		"...hindi siya basta-basta mawawala sa software..."	"...hindi nila mako-control yung ginagawa mo."		"...okay yun kasi secured yun..."		"...traceable naman siya..."		
<b>Comprehensive</b>	"...kaya niyang humawak ng large volume of data..."				"...you have the option to expand the report..."			"...makikita mo na lang, ah okay ito na pala yung nangyari..."	"...meron din siyang ganun na feature..."	"...kaya niya magprocess ng data and mag-generate ng report..."
<b>Familiarity</b>						"...madali naman kabisahin..."		"...mahirap siyang i-access at first..."		"...if you have no basic knowledge about accounting, it will be very difficult..."

User-friendly, secured, comprehensive and familiarity were the underlying themes of the first master theme identified, which was ease of use. This master theme relates to the experiences of industry practitioners and end-users when interacting with the system. It included aspects like how easy it was to use and access the system, how simple it was to navigate its features, and how beneficial it was for their careers.

The theme of user-friendly was composed of factors such as straightforward design and navigation, clear instructions and prompts, and guides that enabled them to perform their tasks effectively. The majority of the participants attested to this fact, as they stated that it was easy to understand and that there was minimal confusion they encountered while using the system. Additionally, a participant also mentioned that one does not need to be technologically savvy to be able to use the system, as the majority of the features were intuitive and required little to no technical knowledge, which made it accessible to a wide range of users.

Secured, on the other hand, referred to the level of protection and privacy that the practitioners perceived the system to be providing them. The research participants had repeatedly mentioned that they believed that the SAP accounting system was relatively safer compared to other systems they had used before. They had attributed this to the manner in which their data were encrypted and were stored in secured servers. The data and information that they had encoded within the system in relation to the transactions they had encountered were also stored within the server and were not easily deleted or affected by physical events. Additionally, this theme also referred to the assurance that the practitioners received that the information within the system cannot be easily controlled, modified, or deleted by anyone other than those who had the necessary qualifications.

SAP accounting software was also described to be comprehensive, which meant that it could cover a wide range of functions and could handle complex financial transactions. The system was said to have the capability of generating different types of reports that would suit different needs of the users such as sales report, financial statements, inventory summary, and such. The participants also described the system to be capable of processing huge volumes of data and compiling such information into meaningful and understandable formats. Furthermore, the participants also emphasized that the system also offers advanced features such as automated data-entry, real-time updates and compatibility with different devices.

Lastly, the theme of familiarity pertained to the need of the users to have at least basic knowledge about the accounting processes to be able to use the system to its full capability. There was also a need for the practitioners to have basic knowledge of computer skills in order to effectively use the system. The participants also stated that the system would need time to get used to and that users should expect to have to learn and familiarize themselves with the interface before they can execute tasks smoothly. Regardless, after the initial learning curve, the practitioners assured that the users would not encounter any problems as they continuously use SAP accounting software in their profession.

Table 13

Master Theme No. 2 Performance Optimization

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
<b>Accessible</b>			"... easily access ..."			"... nakikita kasi yun lahat..."	"... kita mo lahat..."		"... kahit anong device yung gamit..."	"... kahit nasa ibang bansa sila..."
<b>Automatic</b>		"... automatic na yun mag-generate ..."		"... automatic na siya nagge-generate ..."		"... automatic siyang ulhm nakikita ..."				
<b>Complete Accounting Cycle</b>		"From recording to end, revision ng reports..."					"... end to end accounting process..."	"... nag-iimport or nag-journal ako..."		
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
<b>Multi-tasking</b>	"... pwede kang mag multi-task ..."				"... tatlong T-codes at the same time pwede siyang buksan ..."					
<b>Flexibility</b>		"... nandyan na lahat..."						"... nag-ooffer siyang wide range of modules ..."	"... madaming lumalabas ..."	

The second master theme identified was performance optimization. This comprised the themes of multi-tasking, flexibility, accessible, automatic, and complete accounting cycle. This master theme explored the perceptions of industry practitioners with regards to the system's ability to optimize their performance and enhance their productivity. The theme additionally addressed the manner in which the software enhanced accuracy, optimized procedures, and supported the practitioners' ability to make decisions.

The theme of multi-tasking described the system's ability to handle different tasks simultaneously without affecting the quality of the work or causing delays. This allowed the practitioners to efficiently manage their workloads and meet deadlines. The statement of one of the participants even outlined how they had experienced opening different windows at the same time, which allowed them to work on different parts of the accounting cycle while still being able to access and reference information from other modules within the system. This was said to be a unique experience for one participant who also had experience with other systems like Oracle, but were unable to do the same with those systems.

The second theme of flexibility pertained to the industry practitioner's perception of the system's ability to adapt and cater to different workflows and accommodate different business processes and organizations. The study revealed that the practitioners believed that SAP accounting software allowed them to perform their tasks regardless of what their profession may be—accountants, auditors, financial analysts, and such. They also mentioned that the software also provided them with a wide range of modules that they could utilize however they see fit to execute their necessary job functions.

The practitioners also described SAP accounting software as accessible, which made navigation and data analysis relatively effortless. They had stated that they were able to access the system regardless of the device that was available to them and the location where they were working, even if they were overseas. Additionally, the practitioners also stated that the system also provided them with real-time updates and notifications, which allowed them to stay informed about any changes or important information. They had also experienced being able to easily view complete information about a specific transaction or report without having to navigate through different screens or modules.

The system was also described as automatic in terms of its ability to streamline processes and reduce the manual tasks that the practitioners had to execute for their job functions. The majority of the practitioners stated that all they had to do was input the pertinent information about the transaction, and the system would generate the reports for them and provide them with the time needed to complete other tasks and increase their overall efficiency. This automated system not only reduced time, but was also stated to have reduced human error and improved the accuracy of the information generated.

Lastly, the practitioners also claimed that SAP accounting software was capable of executing the complete accounting cycle from start to finish. This included the journalizing of transactions, posting to the ledgers, preparation of trial balance, financial statements, and reversing entries. The participants of the study stated that from their experience, the system was capable of an end-to-end accounting process and streamlining the workflow with minimal human intervention for them. They had also mentioned that

all they had to do was to input the information about the transactions, and the system would be able to fulfill the rest.

Table 14

*Master Theme No. 3 Customer Support*

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
<b>Availability</b>		"... hindi siya palaging ano, available eh."	"... medyo busy din sila ..."				"... medyo matagal kasi siya ini-investigate ..."	"... hindi sila nag-rireach out agad ..."	"... hindi mo alam saan ka makikipag-coordinate ..."	
<b>Responsive Support Team</b>	"... para hindi na siya mag-occur in the future ..."			"... nagagawa naman siya agad ng paraan ..."	"... they immediately review ..."	"... ma-remote na nila yung PC."	"... mabilis naman maresolve yung issue ..."			"... pinaka-summary ng steps na ahn ginawa nila to address the issue ..."

The third master theme identified was customer support, which comprised the themes of availability and responsive support team. This pertained to the experiences of industry practitioners with the customer support provided by SAP accounting software, specifically in terms of their availability and their responsiveness with regards to addressing any problems or potential concerns.

The theme of availability referred to the ease of access to the customer support provided by SAP accounting software, and how a user would be able to interact with them through different mediums—phone, call, email, ticketing system, and such. However, the practitioners described the customer support team as largely unavailable, with them having to schedule fixes ahead of time and experiencing long wait times for responses to certain problems. The research participants also pointed out that there were some instances wherein they had to wait for a long time for the support team to reach out to them and offer resolutions to their problems, which was detrimental to their productivity as they were unable to proceed with their work until the issue was resolved.

The theme of a responsive support team, on the other hand, pertained to the timeliness and efficiency of the support team when responding to their issues. The practitioners stated that, based on their experience, the resolutions that were offered to them were

more long-term to ensure that such problems would not occur again in the future by making direct changes to the programming of the software or releasing updates to minimize the bugs that they encountered. Additionally, they also stated that they were provided with a resolution report at the end, which outlined the steps that the support team had taken to resolve the issue and further guidelines on what the users can do if such problems arise in the future to ensure that they can handle them independently, which would expedite the process of finding a solution.

Table 15

*Master Theme No. 4 User Satisfaction*

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Dependability	"...mas secured, mas structured and mas safe..."				"...iwas din siyempre sa mga... fraudulent actions."	"...may record ang lahat..."			"...hindi siya mag-iinput pag mali..."	"...less na din yung mga errors..."
Convenience		"...mag-fifill out ka lang..."	"...convenient naman siya..."	"...nate-trace naman siya..."				"...yung software na mismo yung nag-aasikaso nun."		
Competence	"...madaling intindihin yung logic..."		"...nagagawa naman na nila yung kailangan nilang gawin..."		"...as much as how many details you want to see..."	"...lahat ng details nandun..."	"...impressive din yung responsive ness ng system..."		"...relationship map..."	"...highly efficient siya sa pag-capture accurately ng mga data..."
Intuitive System				"...nag-generate ng uhm journal entry..."	"...kasi encouraged kana to record it..."		"May error-checking features din siya..."		"...mag-wawaming naman si SAP..."	"...mag-generate ng report na proven to be accurate..."
Time Efficient		"...nandun na lahat ng data..."		"...male-less nalang yung workload..."	"...you just have to input ano yung gusto mo makita..."	"...isang tingin mo lang sa screen..."	"...nake-carry out ko ang tasks ko ng walang delays..."	"...mabilis na lang siya..."	"...mas mabilis nagagawa..."	"...nakakasave siya ng time..."

User satisfaction was the fourth master theme identified, which was composed of dependability, convenience, competence, intuitive system, and time efficient. This theme explored the perceptions and overall satisfaction of the industry practitioners with the system and how it had a positive impact on their work efficiency and productivity. It also expanded to the experiences of the practitioners with the system interface, navigation, and ease of use.

The theme of dependability examined the experiences of industry practitioners with the reliability and consistency of the



system in delivering accurate results and its ability to perform tasks without problem. The study revealed that the majority of the practitioners perceived the system to be more secure, more structured, and more organized, which contributed to their overall satisfaction. They had also pointed out that, due to the system keeping track of every movement of the users within the system, they had the assurance that their actions were being monitored and could be traced back if needed. This also reduced the risk of fraud, discrepancies, and unauthorized modifications of the information within the system, which enhanced the system's reliability and trustworthiness.

The industry practitioners also described SAP accounting software as convenient because they were able to access and retrieve data easily, enabling them to optimize their work performance and make informed decisions. They mentioned that they could just fill out information and the system could interpret the results for them. Additionally, the practitioners also stated that they were able to trace the entire financial trail easily, and detect any discrepancies, and identify errors.

The third theme identified was competence, which pertained to the ability of the system to perform its intended functions accurately and effectively. The practitioners had claimed that, based on what they had seen, the system was able to execute the tasks they expected it to accomplish smoothly and without any errors. They had also stated that the system was capable of providing them with the complete information and reports they needed to make informed decisions and perform their tasks effectively. They also mentioned the ability of the system to produce a relationship map that showed how each transaction was interconnected with another and allowed them to be able to identify any potential issues or bottlenecks in the process.

The study also showed that the practitioners believed that SAP accounting software was an intuitive system, which meant that they could use the system with minimal training or technical knowledge. The system was said to be able to function with little to no downtime or errors, ensuring smooth and uninterrupted workflow for the practitioners. Additionally, the study revealed that the intuitive nature of the system also contributed to a reduction in human errors and increased accuracy in financial reporting through the warning and detection feature of the software.

Lastly, the system was also perceived to be more time efficient compared to manual processes, allowing the practitioners to complete tasks effectively and efficiently. This also lessened the workload of the practitioners and enabled them to focus on more important tasks and streamline the processes within their department. They had also pointed out that the system was capable of analyzing information within a short period of time, which allowed practitioners to make data-driven decisions quickly rather than going through each and every transaction one by one beforehand.

Table 16

*Master Theme No. 5 Internal Controls*

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
<b>Human Errors</b>	"... set up yung general rules ..."				"... tendency is hindi mo na siya mane-neglect i-record ..."		"... tao pa rin yung nag-input ng data ..."	"Inulit ko nalang talaga ulit."		"... mag-iinput ka ng info tapos mali pala yung code ..."
<b>Verification</b>		"... supervisor na mag-check ..."		"... may monitoring ka ..."	"... may next level checking pa ..."		"... may double-checking and verifying ng information ..."			
<b>Data Immutability</b>			"... hindi siya madaling i-delete ..."	"... kung ano yung na-save mo ayun na talaga siya ..."		"... nakikita yun lahat eh lahat ng changes mo ..."			"ma-tatrack mo na agad ..."	

The next master theme identified was internal controls, which consisted of human errors, verification, and data immutability. This primarily focused on the safety measures that the practitioners had noted and the level of trust that they had with regards to the security of the system. Additionally, this theme also examined the perception of the practitioners with the effectiveness of the system to detect and prevent fraudulent activities or unauthorized transactions.

The practitioners noted that it was important that the system had internal control measures set in place to accommodate for the inevitability of human errors when using the system. They had pointed out that since the system was dependent upon the information that the users had encoded, there would still be a possibility of making mistakes that can affect the output that would be produced in the form of reports or summaries. Furthermore, the

practitioners believed that this could be easily mitigated by the system by setting rules and general parameters ahead of time in anticipation of potential errors they may encounter.

The theme of verification emphasized the importance of ensuring that the information within the system was accurate and reliable. The practitioners had mentioned that SAP accounting software works like a safeguard by cross-checking the data entered by the users and appointing a user, namely, a supervisor, to validate the correctness of each transaction encoded. This meant that they simply cannot input information without it being seen, checked, and verified by their higher-ups, which could help reduce mistakes, discrepancies and potential fraud right from the start.

The last theme identified was data immutability, which meant that once data was entered into the system, it cannot be easily deleted, removed, or modified by the user. The research participants stated that what they had entered into the system would remain as is, even if they wanted to change it in the future. The only avenue available to them, as the majority of the participants pointed out, was to simply make a new transaction that would adjust, correct, or balance out the effect of the specific transaction they wanted to change. This feature could be seen as both a disadvantage and an advantage at the same time, as it ensured the integrity of the information and encouraged transparency, it also became a challenge to correct a transaction deemed as incorrect. Furthermore, the participants also said that they were able to not only track each change, but also the users who had made such modifications, which made it easier for them to identify any potential errors or discrepancies within the system.

Table 17

Master Theme No. 6 Data Security and Organization

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
<b>Access Restrictions</b>	"... limited na yung access ..."				"... hindi ako basta-basta makaka input..."	"... if hindi ka part ng finance, hindi ka rin makakapasok ..."		"... kung sino yung nag-eedit and nagdadagdag..."		"As napromote ka, saka lang nadadagdagang yung access mo..."
<b>Coded Transactions</b>		"... meron siyang code na ginagamit ..."	"... madami siyang T codes..."	"... meron siyang series na pino-provide yung SAP..."	"... may assigned codes na for every type of accounts ..."	"... T-Codes na ginagamit nila ..."			"... matatrack mo na agad ano yung source document ..."	
<b>Input – Output Principle</b>					"... pwede mo kasi ma-set eh what do you want to see..."		"... hindi specifically included sa programming will not be displayed..."			

The sixth master theme identified was data security and organization, which pertained to the manner in which practitioners perceived SAP accounting software to store and protect information within the system. This also explored the practitioners' view on the ease of accessing data and its overall organization within the software. This included the themes of access restrictions, coded transactions, and the input-output principle of data organization.

Access restrictions referred to the limitations placed in which users were permitted to access certain information, modules, or reports. The practitioners revealed that they were not able to access everything within the system, and that what they could see was limited only to what was considered necessary for their job functions. The research participants also clarified that even though SAP was primarily an ERP system that could do virtually anything and encompass every department within their company, only those users who were part of the finance or accounting department could view the financial information, barring those who were also qualified for such from other departments. They also stated that access was proportional to the position one held within the organization and that as they got promoted, the higher their access to SAP accounting software would be. The next theme identified was that the system uses coded transactions to organize the data that had been added by the users. The practitioners mentioned that SAP uses T codes, or transaction codes, which each represent a specific entry point

within the system. They had mentioned that not everyone knows what these T codes were, and that they were only given to those who were qualified to access the information associated with each code. The participants also mentioned that each transaction, data, or piece of information entered into the system was automatically associated with a code that one could use to track it again or associate it with another transaction to establish a connection.

The last theme associated with this master theme was the implementation of the input-output principle when organizing data within the system. This referred to the manner in which data was entered into the system and how it was presented to the user when it was retrieved. The practitioners claimed that one could customize the system to show data in a way that was most meaningful and relevant to the user. Furthermore, they had clarified that the system could only show the information that was specifically programmed to be displayed, and any information or transactions that were not would not be shown regardless of which user accessed the system. This meant that the system would only function when the practitioners had properly entered the information they needed for their intended purpose.

Table 18

*Master Theme No. 7 System Limitations and Interface Issues*

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Technical Limitations	"...may mga systems limitations din siya..."				"...internet connection problem..."	"...pag pumasok ka dun sa detailed na na shipment, August pa pala siya na-deliver..."		"...sometimes nagbabago din yung value niya..."	"...kailangan ng internet..."	
System Overload		"Nag-overload yung system..."		"...matagal lang siya mag process..."					"...babagal din yung pag-load..."	
Outdated Interface			"...primitive..."			"...kung ano yung button na yun kasi walang name..."	"...maging updated pa rin siya..."			"...medyo outdated or basic lang yung itsura niya..."
Data Overload			"...mabigat din si SAP magbigay ng mga data input..."			"...mahirap yun kasi sa dami ng data..."				
Specification				"...dapat buong remarks kumpleto dapat yun..."	"...higher level na pala yung naka access nun..."					

The last master theme that was identified was system limitations and interface issues, which pertained to the issues that industry practitioners faced when utilizing the software. This stemmed from the themes of technical limitations, system overload, outdated interface, data overload, and specification. The challenges primarily revolved around the difficulties with the implementation of certain features due to technical glitches, compatibility issues, or system overload. Some may be attributed to the interface, design, and layout itself, which affected the interaction between the user and the system.

The theme of technical limitations were primarily about the restrictions and problems that the users encountered that could be attributed to the programming of the system itself. The practitioners had noted that certain functions that they expected to be able to do using the system were not executed or were simply not existing. As the software itself relied on the internet connection of the users, some problems arose when they experienced connectivity issues, such as functionalities not available or data not being saved properly. The second theme discussed by the practitioners was system overload, which focused on the limitations of the system with regards to the compatibility with the devices and how it affected the performance of the system. This issue affected the speed and performance of the software, causing delays or lagging in its functionality and the productivity of the users.

The outdated interface identified referred to the perception of the practitioners with the interface itself, which some described as simple, basic, or outdated. This theme also included some problems that some participants noted with the design of the system icons that were improperly labeled or had too small labels, which caused the users to experience problems. These practitioners also expressed the need for the interface to be further improved upon to make it look more modern and up-to-date. The participants in this study also noted that they also experienced data overload when trying to extract data from the system. They had mentioned that this was inevitable regardless of the system used, as accounting deals inherently with large amounts of data that they needed to summarize, analyze, and interpret within a short period of time. They had mentioned that it was difficult to extract data to the level that they need it to and simultaneously use the system for another task. The system would also need to take a lot of memory space when

undertaking such tasks, which the practitioners had taken into account.

The last theme identified was the need for specification when trying to utilize the system. The research participants claimed that in order to accurately find a specific transaction, they must know the entire code associated with it, not just a portion, as it would not work. They had also adequately explained that this level of specificity was crucial in order to avoid confusion and ensure accurate retrieval of desired information. Even if they had admitted that this was a challenge, it was a difficulty that they had to undertake to ensure the integrity of the system and safeguard the information within it.

## **DISCUSSION**

### **Experiences of industry practitioners regarding SAP accounting software in terms of: Accessing the Software**

Due to recent developments within the industry, accounting software became an integral part of an accountant's profession (Do et al, 2020). The study identified that the experiences of the industry practitioners with regards to accessing SAP accounting software were positive with some describing the process as user-friendly, convenient, had comprehensive functionalities, kept the information safe and maintained its integrity, and practical with straightforward and clear user interface. A study by Xu (2020) believed that, since the majority of the accounting software had been made accessible and easy to use, accountants were able to accomplish their tasks in a timely manner and improve their efficiency at the same time. Most of the organizations currently endeavor to replace the manual accounting they have been previously using with such accounting software as SAP (Phyu, 2020).

### **Transactions**

Accounting information systems such as SAP are advantageous when it comes to recording accounting transactions and preparing and analyzing financial statements for any organization. (Ibrahim et al., 2020). Fuscaldo claimed that different accounting systems offer various functionalities with some that offer only the basic and others being more advanced and sophisticated. Some systems even aid in the preparation of documents in compliance with the tax regulations set forth by the government. The

rise of accounting software significantly changed the accounting process as a whole, which now encompassed transactional entry, data storage, and even the capability to prepare financial statements accurately under the scrutiny of practitioners.

Furthermore, Turner (2020) added that such ability also expands the internal control systems that an entity can implement to maintain data reliability and integrity. Such internal controls that any information system must contain includes the means to perform segregation of duties, controlling access to the accounting and financial reporting system, capable of double-entry accounting, limits the interaction of management when preparing financial statements, expense verification and limits physical access to cash, equipment, inventory, and others assets (Franklin, 2019).

### **Customer Service**

Customer service satisfaction is an integral aspect of any business as it serves as an indicator of the effectiveness of an organization with regards to meeting the expectations of its users. This could be measured with the quality of the system and the support that the entity provides to ensure that it is running smoothly (Ibrahim, 2019). Due to the continuous increase of organizations modernizing their systems and other technology-driven activities, issues and glitches related to such were inevitable. Thus, it was emphasized that entities primarily responsible for the implementation and maintenance of systems used for this purpose focus on making incident management their priority to be able to provide their users quick and reliable solutions (O'Brien, 2023).

Martin (2023) also claimed that if customer satisfaction was not met, there is a possibility that they would be disinterested with the product and change providers. Especially in an information system wherein users need real-time help when experiencing technical difficulties, it is critical that they be able to resolve the issues immediately. Almost 90 percent of consumers expect to receive immediate response from their providers, moreso with an accounting information system. Entities and providers who are able to meet the demands of their users tend to promote productivity and build positive relationships with their users, specifically the industry practitioners (Nelson, 2022).



### **Experiences of industry practitioners with the efficiency of SAP accounting software in terms of: Recording Transactions**

In the years prior to the advent of the modern era, a vast majority of organizations opted to record accounting transactions using the traditional method, which was unambiguously quite time-consuming and required too much paperwork (Kumar, 2020). Accounting as we know it today, is vastly different to the accounting that we know before (Carnegie, 2022). As time passes by, it becomes evident that changes in the accounting industry must occur to mitigate the challenges that the practice faces such as incomplete data, archaic archiving techniques and extensive cataloging as stated by Turner (2020). This led to the development of various accounting systems that revolutionized the manner in which organizations manage their data and financial information.

A study made by Ghasemi (2019) stated that computerized accounting systems had increased the timeliness of accounting information, which in turn improved the efficiency of accounting departments. Accountants were given the ability to prepare reports and operations analysis within a relatively short period of time, which gave management the ability to make decisions based on extensive information. Shalini (2022) also claimed that accounting systems allowed industry practitioners to process substantially large amounts of data and summarize it into month-end or year-end closing statements that allows for a more accurate and efficient reporting process. This emphasized the importance of having an effective and competent accounting system that would reliably do the things that it was expected to do and help streamline the process for the convenience of the industry professionals.

### **Correcting Mistakes**

White (2019) claimed that computerized accounting systems have built-in internal check and balance measures to ensure that all transactions that were put in the system were properly balanced even before the preparation of financial statements occur. Thus, reducing the chances of errors, fraud, and discrepancies while at the same time enhancing the accuracy, reliability, and efficiency of financial reporting. Shalini (2022) also stated that accounting systems also modernized the auditing process due to internal control measures that have been put in place within the software.

Kerner (2022) emphasized the need for a system, especially one that processes information, to have an internal control put in

place to detect inconsistencies and have the means to flag them. He claimed that any output that a given system would produce can only be as accurate and reliable as the data that is input within it. Bui (2020), on the other hand, pointed out that some problems that users encounter with a system arise from the fact that they lack the knowledge on how to use certain functions correctly or due to their own inadequacies. Due to this, a certain amount of burden had been placed on the system itself to ensure that it would have the means to mitigate such problems and allow users to have reasonable assurance of the accuracy of the information they are able to access.

### **Accessing Information Pertaining Accounts**

The need to access information in real-time and adapt to the rise of digitization of data were answered by the utilization of cloud computing (Moudud-UI-Huq, 2020). Compared to server-based data storage that was prone to damage due to hardware malfunction, natural disasters, and limited storage space. The U.S. National Institute of Standards and Technology (NIST) had set forth standards with regards to the cloud space, which included the need for it to be able to function with minimal human interaction, broad network access, resource pooling, rapid elasticity, and the ability to offer measured services. These characteristics emphasized the need for the user to have on-demand access to the information that had been inputted within the system regardless of their location, time period, or devices. This allowed them to perform their respective functions efficiently and effectively, which enhanced the overall productivity of the organization.

Syah (2023) also added that accounting systems should be able to be customized to fit the needs and the requirements of each user, with modifications that include restricting access and version control. As the availability of information also poses a risk to the confidentiality of certain information, the system should be able to control the users who can freely access certain accounts. This way, only those who had the qualifications would be able to view, modify and analyze data and protect the overall integrity of the reports and outputs they would be able to produce.

### **Problems encountered by industry practitioners in using SAP accounting software**

Bakr (2020) stated that the primary problems that a user experiences with any accounting information system arises from the

fact that the system was not properly designed or causes confusion to the users. Systems are products of structure and action, which allow for each user to interact and interpret it differently (Quattrone, 2019). This meant that each user had certain expectations about the system that they expected to be met, but were rather disappointed when it was not.

Furthermore, as accounting systems are a product of technology, it is prone to technical issues that arise from system overload, slow internet connectivity and device incompatibility, which can negatively affect the experience of users with regards to a certain system (Trucco, 2018). Linx (2023) stated that there was a direct correlation between the design of the user interface and the errors that the users are more likely to make. If an interface was poorly designed, it is expected that the users would be more prone to make more mistakes as they are confused or distracted by the design of the system. A good interface design is all about its form and function, not just its overall appearance. The interface design should allow the users to easily perform the tasks that they need to complete, while also being flexible, reduces error, saves user time and frustration (Admin, 2023). This emphasized the importance of a well-designed system that was not only able to execute tasks effectively, but also pleasing to the eyes of the industry practitioners who would use it.

## **Conclusion**

The following were the conclusions drawn based on the findings of the research:

1. SAP accounting software was an effective tool to use for industry practitioners in their respective fields. Industry practitioners had looked to SAP, one of the top ERP solutions for companies, as one of the most accessible and potent accounting programs available today. SAP offers a comprehensive coverage of key functions such as supply chain management, procurement, customer relationship management, management reporting, accounting, and a few other processes. Because it provided flexibility in accessing the system—on-site, cloud-based, or hybrid—it greatly simplified the lives of industry practitioners and anybody else who uses it. Practitioners had an easier experience in collaborating with other users in other locations as it updates

real-time. The software's user-friendly design had been praised by industry practitioners for making navigation simple and easy. The companies also offer customer support to make sure that issues that arise when using SAP are also effectively managed, cutting down on wait times and guaranteeing quick problem resolution, ensuring that industry practitioners encounter as few issues as possible.

2. Industry professionals had stated that SAP accounting software provides a complete procedure, from data collection to the creation of financial statements. Because it is an all-in-one program, this made it one of the accounting programs that was most highly recommended. Professionals had emphasized that it had the capacity to handle massive volumes of data while maintaining integrity. SAP was also praised by experts for its reliability features since the program includes strong internal controls that ensure certain accounts may only be accessed by those who truly need to utilize them. As experienced by professionals, requests for access to specific accounts and codes must be justified before they can be approved. SAP also offers a built-in system control to ensure that practitioner error is kept to a minimum. Professionals claimed that preventative control procedures, which reduce errors and improve data accuracy, had given them the assurance that the program was reliable and that no transactions were fabricated.
3. Despite being considered as one of the best accounting software available today, industry practitioners often encountered a few problems with SAP accounting software. The interface and system limitations were the most frequently mentioned issues. Professionals had noted that while the software has a user-friendly interface, some users may prefer a more modern style. Industry practitioners preferred to increase the precision of the interface because new users may become confused by its display of several features. Incompatibility of devices, access limitations, system overload, and difficulty with internet connections were among the other obstacles encountered by practitioners. Although access limitations were necessary for internal control, certain users encountered delays because higher-ups must first provide permission.

## **Recommendations**

In light of this study and based on the conclusions drawn, the researchers would like to recommend the following:

1. **Industry Practitioners.** Industry practitioners should seek training on how to use SAP accounting software, as this software is versatile and very convenient to use compared to other software. Also, they should read the study, as it will give them an idea of the kinds of jobs that use the software.
2. **SAP accounting software.** The SAP accounting software personnel should read and use this study, as the research also serves as a survey of users' lived experiences when using their software, which will make them aware of the problems most commonly encountered by their users and enable them to improve their software based on the data gathered by the researchers.
3. **Accountancy students.** Students should strive to learn more about accounting software, particularly SAP accounting software, as it will be of great assistance to them someday, as their future careers will certainly use various accounting software to make their work easier. The lived experiences of the industry practitioners who use the software will enhance their understanding and knowledge regarding SAP.
4. **Professors.** Professors may use the study as a reference for teaching students the various possibilities they can explore using SAP accounting software. It will not only help the professors themselves with their careers but also greatly help the students taught by the professors.
5. **Emilio Aguinaldo College - Cavite.** The school should teach SAP accounting software using a different perspective or approach than the curriculum already present in the school. They can also use the study as a reference for deciding if there is a need to add accounting software to their curriculum so that the accounting students will be able to experience different accounting software that will greatly help them when they go on to work in their chosen field.

6. **Future researchers.** Future researchers may conduct a study similar to this with a much broader scope or from a different perspective. They can also use different data-gathering techniques. Future researchers may also choose various accounting software other than SAP as the focus of their research.

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# GENERATIONAL PERCEPTIONS IN DASMARINAS, CAVITE: EXPLORING ATTITUDES TOWARDS VISIBLE TATTOOS, HIJABS, GENDER EXPRESSIONS, AND EX-CONVICTS IN THE HOSPITALITY INDUSTRY

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## KEYWORDS:

- **Visible tattoos**
- **Hijabs**
- **Gender expressions**
- **Ex-convicts**
- **Generations**

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**Abstract** Stereotypes often breed prejudices, forming biased opinions about individuals devoid of factual experience or rationality, often resulting in favoritism towards certain individuals or groups. This study was conducted to examine the manifestation of discrimination and social issues stemming from stereotypes across different

generations. Employing a descriptive-correlational research design following a explanatory quantitative approach, the attitudes of various generations—Baby Boomers, Generation X, Millennials, and Generation Z—towards the inclusion of

individuals with visible tattoos, wearing hijabs, exhibiting diverse gender expressions, and those with prior convictions in the hospitality industry in Dasmarinas, Cavite were determined. Spearman's Rho Correlation and mean scores revealed a discernible trend across generations in Dasmarinas, with the hospitality sector showing increasing acceptance of people with visible tattoos, wearing hijabs, and have diverse gender expressions. However, individuals with prior convictions faced heightened reservations, though some support was noted, indicating a prevailing inclination towards inclusivity with lingering concerns. Expanding the scope of investigation beyond hospitality could provide a more comprehensive understanding of workplace attitudes. These findings offer actionable insights for hospitality businesses to make informed decisions and implement measures fostering inclusivity and respect. From dispelling stereotypes to addressing concerns and shaping policies, understanding generational perceptions is crucial for nurturing a diverse workforce and creating a welcoming environment for customers.



# **GENERATIONAL PERCEPTIONS IN DASMARINAS, CAVITE: EXPLORING ATTITUDES TOWARDS VISIBLE TATTOOS, HIJABS, GENDER EXPRESSIONS, AND EX-CONVICTS IN THE HOSPITALITY INDUSTRY**

## **INTRODUCTION**

The hospitality industry has witnessed shifts in societal attitudes towards visible tattoos, gender expression, and the acceptance of ex-convicts, with generational differences influencing perceptions. While Baby Boomers exhibit confidence in themselves and their abilities, Gen Xers are often depicted as cynical, stemming from economic and social challenges. Conversely, modern generations like Gen Z and Millennials challenge traditional norms, advocating for inclusivity and progressiveness. Despite extensive research on stigma cases surrounding visible tattoos, hijabs, gender expressions, and ex-convicts, there is a notable gap in understanding how different generations perceive these stereotypes within the hospitality industry, particularly in the Philippines. This study seeks to fill this gap by exploring generational perspectives, lifestyles, and evolving perceptions, aiming to raise awareness of discrimination within the hospitality industry among each generation. A person born between 1946 and 1964 is known to as a baby boomer followed by Generation X that born between 1965 and 1980, millennial generation that those who born between 1981 and 1996. It was first used in William Strauss and Neil Howe's book *Generations* (1991), who thought it was an appropriate name for the first generation to reach adulthood in the new millennium. Then, Generation Z were born between the late 1990s and the early 2000s.

The Indeed Editorial Team (2023) discusses the multifaceted nature of attitudes towards visible tattoos in the workplace, acknowledging that while tattoos can serve as a form of individual

expression, some industries may still harbor reservations about allowing employees to display body art due to concerns about customer perceptions. The editorial notes that physical appearance, including tattoos, can significantly influence customers' impressions of the services provided by organizations. Despite increasing acceptance of tattoos in society, discriminatory attitudes persist, with some organizations fearing negative customer reactions to visible tattoos. Particularly in the hospitality industry, where guest perceptions are paramount, managers must be mindful of how customers perceive employees with visible tattoos to ensure positive guest experiences. Hijab for Muslim women is respectable clothing and serves as an identity that shows their modesty. Wearing a hijab can be a religious act – a way of demonstrating their submission to God (Jain, 2021). Muslim women are required to dress modestly with their hijab covering their hair, neck, and part of their chest, especially when they face the public, visitors and at work, believing that this will protect them from impurity thinking. Allah protects a woman who always covers her head as Hijab acts as the Almighty's shield from all the sinful gazes (Anjum, 2022). Gender identity refers to an individual's internal sense of being male, female, or other; gender expression refers to how an individual communicates gender identity to others through behavior, clothing, hairstyles, voice, or body characteristics. Gender is a social construction, which means that gender and the characteristics associated with being male or female are culturally defined rather than biologically defined, according to a significant amount of research. Understanding the impact of gender role ideologies, stereotypes, and values on gender inequality has been particularly important.

The ongoing expansion of the hospitality sector has sparked shifts in societal attitudes towards individuals with visible tattoos, expressions of gender, wearing the hijab, and individuals with prior criminal records, mirroring broader changes in cultural acceptance and identity expression. Many Baby Boomers and Generation X individuals maintain traditional views due to their upbringing and social influences. Conversely, younger generations like Gen Z and Millennials advocate for inclusivity and challenge traditional norms, fostering a more progressive environment that embraces individuality and authenticity. This shift reflects not only changes in longstanding practices but also emphasizes the industry's response and the adaptability of all generations to evolving societal preferences and values.

The study aims to address a gap in research regarding how different generations perceive stereotypes related to visible tattoos, hijabs, gender expressions, and ex-convicts, particularly within the hospitality industry in the Philippines. While numerous studies have explored public perceptions of these stereotypes, there is a scarcity of research focusing on generational perspectives and the factors influencing these attitudes within the specific context of the hospitality sector. By gaining a deeper understanding of how perceptions vary across generations and the factors driving these perceptions, the study seeks to shed light on the discriminatory practices prevalent in the industry and raise awareness of the need for inclusivity and understanding among different generations.

The researchers have sought to achieve the following specific objectives:

1. To analyze the attitudes of different generations such as Baby Boomer, Generation X, Millennials, and Generation Z in Dasmarinas, Cavite towards visible tattoos, hijabs, gender expressions, and ex-convicts in the hospitality industry.
2. To investigate the factors that influence the attitudes of different generations such as Baby Boomer, Generation X, Millennials, and Generation Z in Dasmarinas, Cavite towards visible tattoos, hijabs, gender expressions, and ex-convicts in the hospitality industry.
3. To determine whether there is a significant relationship between generations and attitudes towards visible tattoos, hijabs, gender expressions, and ex-convicts in the hospitality industry.

## **METHODOLOGY**

Employing a descriptive-correlational research design following a concurrent quantitative approach investigate the attitudes of different generations in Dasmarinas, Cavite towards visible tattoos, hijabs, gender expressions, and ex-convicts in the hospitality industry. The researchers collected a total of 400 respondents consists of Generation Z, Millennial, Generation X, and Baby Boomer. Slovin's Formula used to get the total

population of 692,227 with 5 % margin of error and a 95% confidence level. The exact numbers of respondents needed from each generation were computed based on the sample size formula from the total population aforementioned. Respondents were randomly selected through Stratified sampling to ensure that the sample is representative of the different generations in Dasmarinas, Cavite.

Respondents	Population Size	Sample Size
Generation Z	214,185	124
Millennial	309,791	179
Generation X	110,018	63
Baby Boomer	58,233	34
	<b>N=692,227</b>	<b>n=400</b>

Table 1. Breakdown of the total number of respondents per generation based on the formula

The researchers conducted in-person surveys with random individual respondents in Dasmarinas, Cavite to collect data. The survey is composed of the following categories: (1) Demographic information and (2) Attitudes towards visible tattoos, hijabs, gender expressions, and ex-convicts in the hospitality industry. (3) Factors Influencing Attitudes Towards Visible Tattoos, hijabs, gender expressions, and ex-convicts in the hospitality industry. A 5- point Likert scale will be used to measure attitudes.

Research Instruments

The researchers will conduct in-person and google forms surveys with random individual respondents in Dasmarinas, Cavite to collect data. The survey will be composed of the following categories: (1) Demographic information and (2) Attitudes towards visible tattoos, hijabs, gender expressions, and ex-convicts in the hospitality industry. (3) Factors Influencing Attitudes Towards Visible Tattoos, hijabs, gender expressions, and ex-convicts in the hospitality industry. A 5-point Likert scale will be used to measure attitudes.

*GENERATIONAL PERCEPTIONS IN DASMARINAS, CAVITE: EXPLORING  
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<b>SURVEY RESPONSES</b>	<b>ATTITUDE INTERPRETATION</b>	<b>VERBAL INTERPRETATION</b>	<b>SCALE</b>
Strongly Agree	Very Positive	Strongly Open and Inclusive	4.21-5.00
Agree	Positive	Moderately Open and Inclusive	3.41-4.20
Neutral	Neutral	Mixed feelings and in doubt	2.61-3.40
Disagree	Negative	Somewhat Cautious and Closed- Minded	1.81-2.60
Strongly Disagree	Very Negative	Strongly Closed- Minded and Exclusive	1.00-1.80

*Table 2. Likert Scale Interpretations on respondent's attitudes towards visible tattoos, hijabs, gender expressions, and ex-convicts in the hospitality industry*

<b>SURVEY RESPONSES</b>	<b>FATORS INFLUENCING INTERPRETATION</b>	<b>VERBAL INTERPRETATION</b>	<b>SCALE</b>
Extremely	Very Positive	Very Strong Positive Influence	4.21-5.00
Very Much	Positive	Strong Positive Influence	3.41-4.20
Moderately	Neutral	Neutral	2.61-3.40
Slightly	Negative	Strong Negative Influence	1.81-2.60
Not at all	Very Negative	Very Strong Negative Influence	1.00-1.80

*Table 3. Likert Scale Interpretations on respondent's influence on attitudes towards visible tattoos, hijabs, gender expressions, and ex-convicts in the hospitality industry*

Statistical Analysis

Mean scores were computed to measure their attitudes and influence on attitudes, while to understand the significant relationship between the generations and attitudes, Spearman's Rho Correlation was executed.

ATTITUDES	
WEIGHTED MEAN	DESCRIPTIVE MEANING
4.21-5.00	Strongly Agree
3.41-4.20	Agree
2.61-3.40	Neutral
1.81-2.60	Disagree
1.00-1.80	Strongly Disagree

Table 4. Measurement of respondent's attitudes

FACTORS	
WEIGHTED MEAN	DESCRIPTIVE MEANING
4.21-5.00	Extremely
3.41-4.20	Very Much
2.61-3.40	Moderately
1.81-2.60	Slightly
1.00-1.80	Not at all

Table 5. Measurement of factors influencing respondent's attitudes

GENERATIONAL PERCEPTIONS IN DASMARINAS, CAVITE: EXPLORING  
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Ethical Consideration



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RESEARCH AND DEVELOPMENT OFFICE

ETHICS REVIEW CERTIFICATION

Title of Research Protocol	Generational Perceptions In Dasmariñas, Cavite: Exploring Attitudes Towards Visible Tattoos, Hijabs, Gender Expressions, and Ex-convicts in the Hospitality Industry		
EACC ERC Code	2023-02-061	Study Site	Dasmariñas, Cavite
Name/s of Researcher/s	Pareja, Christine Joy Vidad, Shannen Rae Marzan, Roselle Develos, Marklen	Contact Information	Tel No: Mobile No: 09755973016 Fax No: Email: srcvidad.cvt@eac.edu.ph
Co-researcher/s (if any)			
School/College/Department	SCHOOL OF TOURISM AND INTERNATIONAL HOSPITALITY MANAGEMENT		
Institution	EMILIO AGUINALDO COLLEGE CAVITE		
Address of Institution	CONGRESSIONAL EAST AVE., BUROL MAIN, DASMARINÁS, CAVITE		

This is to certify that the above-titled protocol **HAD UNDERGONE REVIEW** by the members of the Emilio Aguinaldo College – Cavite Ethics Review Committee and is hereby

- ☒ **GRANTED APPROVAL**, having been found free from ethical issues and violations set forth by the EACC Ethics Review Committee.
- ☐ **GIVEN 'PENDING APPROVAL' STATUS**, having been found with ethical issues and violations set forth by the EACC Ethics Review Committee, hence, **subject for revision and resubmission for another review**.
- ☐ **EXEMPTED FROM REVIEW**; the protocol does not involve human subjects/respondents/participants.

**MR. ERNESTO U. GUILLERMO JR.**  
Chair, EACC Ethics Review Committee  
Date: 12/19/2023

**DR. BRANDON G. SIBBALUCA**  
Director, EACC Research and Development Office  
Date: 12/19/2023

QF-RDO-025 (10.14.2023) Rev.04

• VIRTUE

• EXCELLENCE

• SERVICE

RESULTS

Attitudes of each Generations Towards Visible Tattoos, Hijabs,  
 Gender Expressions, and Ex-convict in the Hospitality Industry

Statements	Gen Z		Millennial		Gen X		Baby Boomer	
	Mean	Descriptive Meaning	Mean	Descriptive Meaning	Mean	Descriptive Meaning	Mean	Descriptive Meaning
I am comfortable being served by a hospitality employee that has visible tattoo:	3.98	Agree	3.76	Agree	4.51	Strongly Agree	4.15	Agree
I believe that it can affect a hospitality employee's professionalism and trustworthiness when the employee has visible tattoo:	2.81	Disagree	3.01	Neutral	2.65	Neutral	2.26	Disagree
I am more likely to support a hospitality establishment with employees with visible tattoo:	3.95	Agree	3.80	Agree	4.13	Agree	3.97	Agree
I believe that it is a sign of unprofessionalism when employee has visible	2.46	Disagree	2.50	Neutral	2.38	Neutral	1.53	Strongly Agree



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tattoo:								
I would feel uncomfortable being served by a hospitality employee with visible tattoo:	2.50	Disagree	2.65	Neutral	2.21	Disagree	1.74	Strongly Agree
I believe that they can give opportunity in hospitality industry to people with visible tattoo:	4.03	Agree	3.65	Neutral	4.16	Agree	4.15	Agree
I believe they can be a distraction in the workplace because they have visible tattoo:	2.56	Disagree	2.59	Neutral	2.48	Disagree Agree	2.24	Disagree
I believe that hospitality employee is approachable even if they have visible tattoo:	4.06	Agree	3.74	Agree	4.11	Agree	4.35	Strongly Agree
I believe that it can be a sign of creativity, individuality, rights, and freedom when you have a visible tattoo:	4.01	Agree	3.50	Agree	4.19	Agree	4.18	Agree
I am more likely to support a	4.11	Agree	3.76	Agree	4.40	Strongly Agree	2.29	Strongly Agree

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hospitality establishments that are welcoming and respectful to people with visible tattoo:								
I think that it is important to judge hospitality employee based on their character, not their appearance by visible tattoo:	4.15	Agree	3.89	Agree	4.06	Agree	4.00	Agree
I think that it is important to practice equality in the hospitality industry with visible tattoo:	4.28	Strongly Agree	3.94	Agree	4.21	Strongly Agree	4.24	Strongly Agree
I believe that we should all be more open-minded in accepting hospitality employee with visible tattoo:	4.31	Strongly Agree	4.03	Agree	4.24	Strongly Agree	4.32	Strongly Agree
I think that we should follow the social standard to	3.65	Agree	3.79	Agree	4.43	Strongly Agree	4.65	Strongly Agree

*GENERATIONAL PERCEPTIONS IN DASMARINAS, CAVITE: EXPLORING  
ATTITUDES TOWARDS VISIBLE TATTOOS, HIJABS, GENDER  
EXPRESSIONS, AND EX-CONVICTS IN THE HOSPITALITY INDUSTRY*

hospitality employees with visible tattoo:								
I think that the hospitality establishment will be shamed if the employee has visible tattoo:	2.25	Disagree	2.63	Neutral	2.35	Disagree	1.94	Disagree
<b>Overall Mean</b>	<b>3.54</b>	<b>Agree</b>	<b>3.42</b>	<b>Agree</b>	<b>3.63</b>	<b>Agree</b>	<b>3.47</b>	<b>Agree</b>

*Table 6. Attitudes of each Generation Towards Visible Tattoos in the Hospitality Management*

Statements	Gen Z		Millennial		Gen X		Baby Boomer	
	Mean	Descriptive Meaning	Mean	Descriptive Meaning	Mean	Descriptive Meaning	Mean	Descriptive Meaning
I am comfortable being served by a hospitality employee that has hijab:	4.04	Agree	4.04	Agree	4.27	Strongly Agree	3.85	Agree
I believe that it can affect a hospitality employee's professionalism and trustworthiness when the employee has hijab:	2.61	Neutral	2.87	Agree	2.54	Disagree	2.06	Disagree
I am more likely to	4.09	Agree	3.75	Agree	4.08	Agree	4.06	Agree

*GENERATIONAL PERCEPTIONS IN DASMARINAS, CAVITE: EXPLORING  
ATTITUDES TOWARDS VISIBLE TATTOOS, HIJABS, GENDER  
EXPRESSIONS, AND EX-CONVICTS IN THE HOSPITALITY INDUSTRY*

support a hospitality establishment with employees with hijab:								
I believe that it is a sign of unprofessionalism when employee has hijab:	2.44	Neutral	2.68	Neutral	2.30	Disagree	1.76	Strongly Agree
I would feel uncomfortable being served by a hospitality employee with hijab:	2.64	Neutral	2.70	Neutral	2.37	Disagree	1.91	Disagree
I believe that they can give opportunity in hospitality industry to people with hijab:	4.00	Agree	3.95	Agree	4.25	Strongly Agree	4.09	Agree
I believe they can be a distraction in the workplace because they have hijab:	2.60	Disagree	2.75	Neutral	2.59	Disagree	2.18	Disagree
I believe that hospitality employee is approachable even if they have hijab:	3.94	Agree	3.73	Agree	3.97	Agree	4.18	Agree
I believe that it can be a sign of creativity, individuality,	3.93	Agree	3.47	Agree	4.19	Agree	3.94	Agree

*GENERATIONAL PERCEPTIONS IN DASMARINAS, CAVITE: EXPLORING  
ATTITUDES TOWARDS VISIBLE TATTOOS, HIJABS, GENDER  
EXPRESSIONS, AND EX-CONVICTS IN THE HOSPITALITY INDUSTRY*

rights, and freedom when you have a hijab:								
I am more likely to support a hospitality establishment that are welcoming and respectful to people with hijab:	4.10	Agree	3.69	Agree	4.03	Agree	4.21	Strongly Agree
I think that it is important to judge hospitality employee based on their character, not their appearance by hijab:	4.02	Agree	3.89	Agree	3.79	Agree	3.65	Agree
I think that it is important to practice equality in the hospitality industry with hijab:	4.23	Strongly Agree	3.79	Agree	4.35	Strongly Agree	4.12	Agree
I believe that we should all be more open-minded in accepting hospitality employee with hijab:	4.16	Agree	4.09	Agree	4.41	Strongly Agree	4.56	Strongly Agree

*GENERATIONAL PERCEPTIONS IN DASMARINAS, CAVITE: EXPLORING  
ATTITUDES TOWARDS VISIBLE TATTOOS, HIJABS, GENDER  
EXPRESSIONS, AND EX-CONVICTS IN THE HOSPITALITY INDUSTRY*

I think that we should follow the social standard to hospitality employees with hijab:	3.78	Agree	3.76	Agree	4.13	Agree	4.21	Strongly Agree
I think that the hospitality establishment will be shamed if the employee has hijab:	2.35	Disagree	2.63	Neutral	4.14	Agree	2.38	Disagree
<b>Overall Mean</b>	<b>3.53</b>	<b>Agree</b>	<b>3.45</b>	<b>Agree</b>	<b>3.69</b>	<b>Agree</b>	<b>3.41</b>	<b>Agree</b>

*Table 7 Attitudes of each Generation Towards Hijabs in the Hospitality Management*

Statements	Gen Z		Millennial		Gen X		Baby Boomer	
	Mean	Descriptive Meaning	Mean	Descriptive Meaning	Mean	Descriptive Meaning	Mean	Descriptive Meaning
I am comfortable being served by a hospitality employee that has gender expression:	4.11	Agree	4.26	Strongly Agree	3.73	Disagree	3.65	Agree
I believe that it can affect a hospitality employee's professionalism and trustworthiness when the employee have gender expression:	2.75	Neutral	3.17	Agree	2.44	Neutral	2.26	Disagree
I am more likely to support a hospitality establishment with employees with gender expression:	4.04	Agree	3.99	Agree	3.21	Disagree	3.38	Neutral
I believe that it is	2.23	Disagree	2.62	Neutral	2.48	Disagree	2.21	Disagree

*GENERATIONAL PERCEPTIONS IN DASMARINAS, CAVITE: EXPLORING  
ATTITUDES TOWARDS VISIBLE TATTOOS, HIJABS, GENDER  
EXPRESSIONS, AND EX-CONVICTS IN THE HOSPITALITY INDUSTRY*

a sign of unprofessionalism when employee has gender expression:								
I would feel uncomfortable being served by a hospitality employee with gender expression:	2.35	Disagree	2.36	Disagree	2.41	Disagree	2.59	Disagree
I believe that they can give opportunity in hospitality industry to people with gender expression:	4.08	Agree	4.07	Agree	4.03	Agree	4.12	Agree
I believe they can be a distraction in the workplace because they have gender expression:	2.22	Disagree	2.69	Neutral	2.57	Disagree	2.44	Disagree
I believe that hospitality employee is approachable even if they have gender expression:	4.15	Agree	4.13	Agree	4.11	Agree	4.29	Strongly Agree
I believe that it can be a sign of creativity, individuality, rights, and freedom when you have a gender expression:	3.97	Agree	3.63	Agree	3.70	Agree	4.06	Agree
I am more likely to support a hospitality establishment that are welcoming and	4.15	Agree	3.92	Agree	3.95	Agree	4.18	Agree

*GENERATIONAL PERCEPTIONS IN DASMARINAS, CAVITE: EXPLORING  
ATTITUDES TOWARDS VISIBLE TATTOOS, HIJABS, GENDER  
EXPRESSIONS, AND EX-CONVICTS IN THE HOSPITALITY INDUSTRY*

respectful to people with gender expression:								
I think that it is important to judge hospitality employee based on their character, not their appearance by gender expression:	3.96	Agree	3.72	Agree	3.57	Agree	3.53	Agree
I think that it is important to practice equality in the hospitality industry with gender expression:	4.06	Agree	3.90	Agree	4.13	Agree	4.18	Agree
I believe that we should all be more open-minded in accepting hospitality employee with gender expression:	4.23	Strongly Agree	4.12	Agree	4.19	Agree	4.12	Agree
I think that we should follow the social standard to hospitality employees with gender expression:	3.56	Agree	3.89	Agree	4.35	Strongly Agree	4.50	Strongly Agree
I think that the hospitality establishment will be shamed if the employee has gender expression:	2.27	Disagree	2.79	Neutral	2.13	Agree	2.53	Disagree
<b>Overall Mean</b>	<b>3.48</b>	<b>Agree</b>	<b>3.55</b>	<b>Agree</b>	<b>3.40</b>	<b>Neutral</b>	<b>3.47</b>	<b>Agree</b>

*Table 8 Attitudes of each Generation Towards Gender Expressions in the Hospitality Management*



*GENERATIONAL PERCEPTIONS IN DASMARINAS, CAVITE: EXPLORING  
ATTITUDES TOWARDS VISIBLE TATTOOS, HIJABS, GENDER  
EXPRESSIONS, AND EX-CONVICTS IN THE HOSPITALITY INDUSTRY*

Statements	Gen Z		Millennial		Gen X		Baby Boomer	
	Mean	Descriptive Meaning	Mean	Descriptive Meaning	Mean	Descriptive Meaning	Mean	Descriptive Meaning
I am comfortable being served by a hospitality employee even if they are ex-convict:	3.28	Neutral	3.02	Neutral	3.08	Neutral	3.06	Neutral
I believe that it can affect a hospitality employee's professionalism and Trustworthiness when the employee with ex-convict.	3.19	Neutral	2.84	Neutral	2.59	Disagree	2.76	Neutral
I am more likely to support a hospitality establishment with employees with ex-convict:	3.35	Neutral	3.20	Neutral	3.11	Neutral	3.26	Agree
I believe that it is a sign of unprofessionalism when employee even if they are ex-convict:	2.65	Neutral	2.50	Disagree	2.41	Disagree	2.47	Disagree
I would feel uncomfortable being served by a hospitality employee that are ex-convict:	2.97	Neutral	2.55	Disagree	2.75	Neutral	3.09	Neutral
I believe that they can give opportunity in hospitality industry to people that are ex-convict:	3.60	Agree	3.30	Neutral	3.57	Agree	3.82	Agree
I believe they can be a distraction in the workplace because they are ex-convict:	2.67	Neutral	2.45	Disagree	2.27	Disagree	2.62	Neutral
I believe that hospitality employee is approachable even if they are ex-convict:	3.56	Agree	3.46	Agree	3.63	Agree	3.82	Agree

*GENERATIONAL PERCEPTIONS IN DASMARINAS, CAVITE: EXPLORING  
ATTITUDES TOWARDS VISIBLE TATTOOS, HIJABS, GENDER  
EXPRESSIONS, AND EX-CONVICTS IN THE HOSPITALITY INDUSTRY*

I believe that it can be a sign of creativity, individuality, rights, and freedom even if they are ex-convict:	3.43	Agree	3.23	Neutral	3.46	Agree	3.71	Agree
I am more likely to support a hospitality establishment that are welcoming and respectful to people even if they are ex-convict:	3.60	Agree	3.32	Neutral	3.38	Neutral	3.53	Agree
I think that it is important to judge hospitality employee based on their character, not their appearance by ex-convict:	3.51	Agree	3.13	Neutral	3.19	Neutral	3.00	Neutral
I think that it is important to practice equality in the hospitality industry even if they are ex-convict:	3.79	Agree	3.36	Neutral	3.49	Agree	3.85	Agree
I believe that we should all be more open-minded in accepting hospitality employee even if they are ex-convict:	3.76	Agree	3.27	Neutral	3.41	Agree	3.62	Agree
I think that we should follow the social standard to hospitality employees even if they are ex-convict:	3.43	Agree	3.20	Neutral	3.43	Agree	3.97	Agree
I think that the hospitality establishment will be shamed if the employee is ex-convict:	2.62	Neutral	2.25	Disagree	2.33	Disagree	2.68	Neutral
<b>Overall Mean</b>	<b>3.29</b>	<b>Neutral</b>	<b>3.01</b>	<b>Neutral</b>	<b>3.07</b>	<b>Neutral</b>	<b>3.28</b>	<b>Neutral</b>

*Table 9 Attitudes of each Generation Towards Ex-Convict in the Hospitality Management*

*GENERATIONAL PERCEPTIONS IN DASMARINAS, CAVITE: EXPLORING  
ATTITUDES TOWARDS VISIBLE TATTOOS, HIJABS, GENDER  
EXPRESSIONS, AND EX-CONVICTS IN THE HOSPITALITY INDUSTRY*

**Factors influencing of each Generations Towards Visible Tattoos,  
Hijabs, Gender Expressions, and Ex- convicts in the Hospitality  
Industry**

Statements	Gen Z		Millennial		Gen X		Baby Boomer	
	Mean	Descriptive Meaning	Mean	Descriptive Meaning	Mean	Descriptive Meaning	Mean	Descriptive Meaning
1. Personal experiences	2.99	Moderately	3.08	Moderately	3.52	Very Much	3.29	Moderately
2. Personal opinions	3.19	Moderately	3.09	Moderately	3.24	Moderately	2.97	Moderately
3. Opinions of others	3.03	Moderately	3.03	Moderately	2.94	Moderately	2.94	Moderately
4. Social media	3.11	Moderately	3.14	Moderately	3.54	Very Much	3.65	Very Much
5. Exposure to people	3.15	Moderately	3.32	Moderately	3.48	Very Much	3.35	Moderately
6. Personal beliefs	3.22	Moderately	3.22	Moderately	3.29	Moderately	3.10	Moderately
7. Cultural norms and expectations	3.22	Moderately	3.28	Moderately	3.54	Very Much	3.53	Very Much
8. Openness to different culture practices	3.27	Moderately	3.13	Moderately	3.94	Very Much	3.94	Very Much
9. Openness to different religious practices	3.18	Moderately	3.25	Moderately	3.60	Very Much	3.53	Very Much
10. Fear of the unfamiliarity	3.07	Moderately	3.12	Moderately	3.63	Very Much	3.56	Very Much
11. Social standard	3.21	Moderately	3.15	Moderately	3.94	Very Much	4.06	Very Much
12. Personal biases	3.06	Moderately	3.07	Moderately	3.65	Very Much	3.68	Very Much
13. News media	3.06	Moderately	3.03	Moderately	3.78	Very Much	3.53	Very Much
14. Social Pressure	3.02	Moderately	2.93	Moderately	3.40	Moderately	3.41	Very Much
15. Level of education	3.25	Moderately	3.05	Moderately	3.37	Moderately	3.24	Moderately
<b>Overall Mean</b>	<b>3.14</b>	<b>Moderately</b>	<b>3.13</b>	<b>Moderately</b>	<b>3.52</b>	<b>Very Much</b>	<b>3.45</b>	<b>Very Much</b>

*Table 10. Factors Influencing of each Generation Towards Visible Tattoos in the Hospitality Industry*

Statements	Gen Z		Millennial		Gen X		Baby Boomer	
	Mean	Descriptive Meaning	Mean	Descriptive Meaning	Mean	Descriptive Meaning	Mean	Descriptive Meaning
1. Personal experiences	2.88	Moderately	2.77	Moderately	2.94	Moderately	2.65	Moderately
2. Personal opinions	3.08	Moderately	3.11	Moderately	3.35	Moderately	3.18	Moderately
3. Opinions	2.96	Moderately	2.73	Moderately	2.63	Moderately	2.53	Slightly

*GENERATIONAL PERCEPTIONS IN DASMARINAS, CAVITE: EXPLORING  
ATTITUDES TOWARDS VISIBLE TATTOOS, HIJABS, GENDER  
EXPRESSIONS, AND EX-CONVICTS IN THE HOSPITALITY INDUSTRY*

of others								
4. Social media	3.03	Moderately	3.13	Moderately	3.32	Moderately	3.35	Moderately
5. Exposure to people	3.12	Moderately	3.20	Moderately	3.86	Very Much	3.79	Very Much
6. Personal beliefs	3.19	Moderately	3.16	Moderately	3.48	Very Much	3.32	Moderately
7. Cultural norms and expectations	3.25	Moderately	3.23	Moderately	3.29	Moderately	3.26	Moderately
8. Openness to different culture practices	3.38	Moderately	3.34	Moderately	3.70	Very Much	3.21	Moderately
9. Openness to different religious practices	3.43	Very much	3.42	Very Much	3.75	Very Much	3.59	Moderately
10. Fear of the unfamiliarity	3.03	Moderately	3.11	Moderately	3.73	Very Much	3.59	Very Much
11. Social standard	2.98	Moderately	3.02	Moderately	3.98	Very Much	3.88	Very Much
12. Personal biases	2.98	Moderately	2.99	Moderately	3.71	Very Much	3.12	Moderately
13. News media	3.08	Moderately	3.00	Moderately	3.35	Moderately	3.09	Moderately
14. Social Pressure	2.95	Moderately	2.96	Moderately	3.19	Moderately	3.00	Moderately
15. Level of education	3.25	Moderately	3.05	Moderately	3.06	Moderately	2.91	Moderately
<b>Overall Mean</b>	<b>3.11</b>	<b>Moderately</b>	<b>3.08</b>	<b>Moderately</b>	<b>3.42</b>	<b>Very Much</b>	<b>3.23</b>	<b>Moderately</b>

*Table 11 Factors Influencing of each Generation Towards Hijabs in the Hospitality Industry*

Statements	Gen Z		Millennial		Gen X		Baby Boomer	
	Mean	Descriptive Meaning	Mean	Descriptive Meaning	Mean	Descriptive Meaning	Mean	Descriptive Meaning
1. Personal experiences	3.25	Moderately	3.37	Moderately	3.29	Moderately	2.59	Moderately
2. Personal opinions	3.18	Moderately	3.22	Moderately	3.06	Moderately	2.85	Moderately
3. Opinions of others	2.90	Moderately	3.01	Moderately	2.78	Moderately	2.85	Moderately
4. Social media	3.14	Moderately	3.12	Moderately	3.06	Moderately	3.38	Moderately
5. Exposure to people	3.26	Moderately	3.37	Moderately	3.40	Moderately	3.18	Moderately

**GENERATIONAL PERCEPTIONS IN DASMARINAS, CAVITE: EXPLORING  
ATTITUDES TOWARDS VISIBLE TATTOOS, HIJABS, GENDER  
EXPRESSIONS, AND EX-CONVICTS IN THE HOSPITALITY INDUSTRY**

6. Personal beliefs	3.26	Moderately	3.17	Moderately	3.37	Moderately	3.21	Moderately
7. Cultural norms and expectations	3.24	Moderately	3.17	Moderately	3.24	Moderately	3.26	Moderately
8. Openness to different culture practices	3.23	Moderately	3.30	Moderately	3.46	Very Much	3.12	Moderately
9. Openness to different religious practices	3.10	Moderately	3.12	Moderately	3.35	Moderately	3.24	Moderately
10. Fear of the unfamiliarity	2.85	Moderately	3.17	Moderately	3.38	Moderately	3.38	Moderately
11. Social standard	3.05	Moderately	3.30	Moderately	3.25	Moderately	3.47	Very Much
12. Personal biases	3.02	Moderately	3.06	Moderately	3.00	Moderately	3.03	Moderately
13. News media	3.21	Moderately	3.08	Moderately	2.95	Moderately	2.88	Moderately
14. Social Pressure	2.94	Moderately	3.08	Moderately	3.24	Moderately	3.06	Moderately
15. Level of education	3.22	Moderately	2.99	Moderately	2.81	Moderately	2.82	Moderately
<b>Overall Mean</b>	<b>3.12</b>	<b>Moderately</b>	<b>3.17</b>	<b>Moderately</b>	<b>3.18</b>	<b>Moderately</b>	<b>3.09</b>	<b>Moderately</b>

*Table 12 Factors Influencing of each Generation Towards Gender Expressions in the Hospitality Industry*

Statements	Gen Z		Millennial		Gen X		Baby Boomer	
	Mean	Descriptive Meaning	Mean	Descriptive Meaning	Mean	Descriptive Meaning	Mean	Descriptive Meaning
1. Personal experiences	3.09	Moderately	2.52	Slightly	3.06	Moderately	2.91	Moderately
2. Personal opinions	3.23	Moderately	2.61	Moderately	2.67	Moderately	2.94	Moderately
3. Opinions of others	3.18	Moderately	2.63	Moderately	2.89	Moderately	2.91	Moderately
4. Social media	3.07	Moderately	2.78	Moderately	3.14	Moderately	3.24	Moderately
5. Exposure to people	3.10	Moderately	2.79	Moderately	3.14	Moderately	3.32	Moderately
6. Personal beliefs	3.15	Moderately	2.83	Moderately	3.11	Moderately	3.24	Moderately

*GENERATIONAL PERCEPTIONS IN DASMARINAS, CAVITE: EXPLORING  
ATTITUDES TOWARDS VISIBLE TATTOOS, HIJABS, GENDER  
EXPRESSIONS, AND EX-CONVICTS IN THE HOSPITALITY INDUSTRY*

7. Cultural norms and expectations	3.10	Moderately	2.65	Moderately	2.84	Moderately	3.32	Moderately
8. Openness to different culture practices	3.10	Moderately	2.56	Moderately	2.67	Moderately	3.00	Moderately
9. Openness to different religious practices	3.17	Moderately	2.92	Moderately	2.98	Moderately	3.09	Moderately
10. Fear of the unfamiliarity	3.07	Moderately	2.72	Moderately	3.21	Moderately	3.44	Very Much
11. Social standard	3.12	Moderately	2.97	Moderately	3.81	Very Much	3.97	Very Much
12. Personal biases	2.80	Moderately	2.78	Moderately	3.40	Moderately	3.62	Very Much
13. News media	3.10	Moderately	2.64	Moderately	3.70	Very Much	3.29	Moderately
14. Social Pressure	2.94	Moderately	2.99	Moderately	3.35	Moderately	3.68	Very Much
15. Level of education	3.19	Moderately	2.96	Moderately	3.16	Moderately	3.47	Very Much
<b>Overall Mean</b>	<b>3.09</b>	<b>Moderately</b>	<b>2.76</b>	<b>Moderately</b>	<b>3.14</b>	<b>Moderately</b>	<b>3.30</b>	<b>Moderately</b>

*Table 13 Factors Influencing of each Generation Towards Ex-convict in the Hospitality Industry*

**Relationship Between Generations and Attitudes Towards  
Visible Tattoos, Hijabs, Gender Expressions, and Ex-  
convicts in the Hospitality Industry**

		<b>Correlation Coefficient</b>	<b>p Value</b>	<b>Relationship</b>	<b>Descriptive Equivalent</b>
<b>Attitudes</b>	Attitudes towards Visible Tattoo	-0.024	0.625	Indirect	Not Significant
	Attitudes towards Hijab	-0.043	0.387	Indirect	Not Significant
	Attitudes towards Gender Expression	-0.046	0.36	Indirect	Not Significant
	Attitudes towards Ex- Convict	-0.037	0.464	Indirect	Not Significant
<b>Factors Affecting Attitude</b>	Factor Influencing Attitudes towards Visible Tattoo	0.064	0.201	Direct	Not Significant
	Factors Influencing Attitudes towards Hijab	0.028	0.573	Direct	Not Significant
	Factors Influencing Attitudes towards Gender Expression	-0.018	0.713	Indirect	Not Significant
	Factors Influencing Attitudes towards Ex- Convict	0.054	0.284	Direct	Not Significant

Table 14. Summary of correlation between the respondents' age/generation, and their attitudes and factors affecting attitudes using Spearman's Rho correlation

## DISCUSSION

Generation Z individuals in Dasmarinas, Cavite, exhibit a predominantly positive attitude towards visible tattoos and Hijab-wearing employees in the hospitality industry, as reflected by mean scores of 3.54 and 3.53, respectively, indicating agreement. Additionally, their favorable perception extends to gender expression, garnering an average score of 3.58. However, there exists a moderate stance regarding the acceptance of ex-convicts in the industry, with an overall average score of 3.29, placing it within the "neutral" category. This suggests that while they are not outrightly opposed to the idea, there are likely reservations or uncertainties about integrating ex-prisoners into the hospitality sector. The study suggests that Generation Z respondents in Dasmarinas, Cavite, are moderately influenced by their environment regarding various aspects of diversity in the hospitality industry. This includes their perceptions of visible tattoos, hijab-wearing, gender expression, and the acceptance of ex-convicts, with all aspects showing a moderate level of influence. The overall means for these perceptions from 3.09 to 3.14, indicating a consistent moderate influence of the environment on Generation Z's attitudes towards these issues in the hospitality sector in Dasmarinas, Cavite.

Millennials generally exhibit a positive attitude towards hospitality employees with visible tattoos, as evidenced by a mean score of 3.42, indicating agreement, with comfort in being served by tattooed staff and support for establishments with such employees, though they express neutrality regarding tattoos affecting professionalism or trustworthiness. Similarly, they show agreement with a mean score of 3.45 on the acceptance of hospitality employees wearing the hijab, reflecting support for equality and comfort in being served by hijab-wearing staff, despite concerns about its impact on professionalism or being a distraction. Regarding gender expression in hospitality, millennials display agreement with an overall mean score of 3.55, indicating support for equality and openness, albeit acknowledging its potential as a workplace distraction. Conversely, their attitude towards ex-convict hospitality employees is largely neutral, with an overall mean score of 3.01,



indicating neither full support nor opposition, suggesting an overall neutrality towards integrating ex-convicts into the industry. The study describes factors influencing millennials' attitudes towards various aspects of diversity in Dasmarinas, with a moderate level of influence observed across the board. For visible tattoos, factors such as personal experiences and exposure to tattooed individuals scored between 2.93 to 3.32, culminating in an overall mean of 3.13, indicating moderate influence. Similarly, factors influencing attitudes towards the hijab yielded an overall mean score of 3.08, with openness to different religious practices being the most influential at 3.42. Regarding gender expression, personal experiences and exposure to diverse individuals scored highest at 3.37, while education level scored lowest at 2.99, contributing to an overall mean of 3.17. Concerning ex-convicts, social pressure emerged as the most influential factor at 2.99, followed by openness to religious practices and personal experiences, resulting in an overall mean of 2.76, all indicative of a moderate level of influence on millennials' attitudes in Dasmarinas towards these aspects of diversity

Generation X respondents from Dasmarinas generally display a positive and inclusive attitude towards various aspects of diversity in the hospitality industry. They show moderate openness and inclusiveness towards visible tattoos, as indicated by an overall mean score of 3.63, despite some expressing reservations. Moreover, they exhibit highly positive attitudes towards hijab-wearing hospitality employees, with a mean score of 3.69 indicating strong agreement and acceptance. Similarly, their positive attitude towards gender expression in the industry, with a mean score of 3.40 and a strong agreement with social norms regarding gender expression, suggests a level of tolerance and acceptance within this demographic. However, their overall attitude towards ex-convict hospitality employees appears neutral, with a mean score of 3.07, indicating mixed feelings and uncertainty, implying a lack of strong opinions regarding the inclusion of ex-convicts in the hospitality sector. Factors influencing Generation X attitudes towards various aspects of diversity in the hospitality industry were examined, showcasing a range of influences on their perceptions. For visible tattoos, openness to different cultural practices and social norms emerged as highly influential, with a mean score of 3.94, while the opinion of others had the lowest impact at 2.94, contributing to diverse attitudes within Generation X. Similarly, factors influencing

attitudes towards the hijab demonstrated a significant influence from social norms, with a mean score of 3.98, reflecting varied perspectives within Generation X. Concerning gender expression, openness to different cultural practices was notably influential, with a mean score of 3.46, highlighting the role of cultural influences and upbringing in shaping their attitudes. Regarding ex-convicts, factors were moderately influential, with the perception of risks associated with hiring ex-convicts playing a significant role, resulting in a moderate overall influence on Generation X's attitudes towards ex-convict employees in the hospitality industry.

Baby Boomers generally exhibit positive attitudes towards diversity in the hospitality industry, as evidenced by their openness towards employees with visible tattoos, with an overall mean score of 3.47, emphasizing equality and providing opportunities regardless of tattoos that do not impact professionalism or trustworthiness. Similarly, they demonstrate support for hospitality employees wearing the hijab, with an overall mean score of 3.41, highlighting respect for establishments that embrace diversity and adhere to social norms, showcasing a positive stance towards hijab-wearing employees. Moreover, Baby Boomers maintain a positive attitude towards gender expression in the industry, with an overall mean score of 3.47, emphasizing professionalism and approachability regardless of gender expression, reflecting their commitment to equality and openness. However, their attitude towards hiring ex-convicts in hospitality, with an overall mean score of 3.28, remains neutral, indicating mixed feelings with some positive inclinations towards offering opportunities and practicing equality, tempered by concerns about professionalism, trustworthiness, and potential disruptions in the workplace, showcasing varying degrees of support and caution towards ex-convict employees. The factors influencing Baby Boomers' attitudes towards various aspects of diversity in the hospitality industry, revealing a significant influence on their perceptions. For visible tattoos, with an overall average score of 3.45, social norms and personal biases emerge as the most influential factors, indicating a strong impact of cultural expectations and individual beliefs on their decisions. Regarding the hijab, a diverse range of factors including personal experiences, opinions, exposure to people, and personal beliefs contribute to their attitudes, showcasing the complexity of views within this generation. Factors influencing attitudes towards gender expression also reflect societal norms, with an overall

mean score of 3.09, indicating a moderate influence of social acceptability. Similarly, regarding ex-convicts, with an overall average score of 3.30, factors such as societal expectations, personal biases, experiences, education level, and exposure to different cultures all contribute to their attitudes, underscoring the multifaceted nature of their perceptions and emphasizing the importance of considering various factors when addressing these issues

Overall, there is no significant correlation between the respondents' age/generation, and their attitudes, nor with the factors affecting attitudes. It means that in general, the respondents' attitudes, as well as their perceived factors affecting their attitudes do not increase or decrease in a significantly consistent proportion with their age or generation.

## **Conclusion**

The study revealed that younger generations like Generation Z do express more accepting and inclusive attitudes towards visible tattoos, hijabs, gender expressions, and even ex-convicts with some nuances. However, interestingly, the research also indicates that older generations like Millennials and Baby Boomers are demonstrating an evolving acceptance towards these stereotypes as well. Their initial stance might not be as readily accepting as Generation Z, but the overall trend seems to be moving towards greater inclusivity across generations. This suggests a potential convergence of attitudes as older generations become more exposed to these groups and have positive personal experiences, possibly influenced by the changing social norms and values by younger generations. It is possible that the attitudes of older generations also change, and "catch up" with the attitudes of younger generations.

This study addressed the gap on generational perceptions on Visible Tattoos, Hijabs, Gender Expression, and Ex-convict in the Hospitality Industry. The findings revealed significant differences in how Filipinos from various generations perceive these stereotypes. By understanding these variations, we can begin to address discriminatory practices within the hospitality sector. This research underscores the need for increased awareness and education across generations to

promote inclusivity and understanding showing that there is no consistency in the data.

## **Recommendations**

From the conclusions, the following recommendations are made:

The study emphasizes the importance of education in overcoming stereotypes and fostering inclusivity in diverse workplaces, particularly in the hospitality industry. Study advocates for programs and workshops addressing unconscious biases and providing accurate information about different groups to dispel misconceptions. By promoting genuine understanding, such education enables individuals to appreciate each other's unique stories and embrace diversity. The research suggests that hospitality businesses can enhance inclusivity through training, diversity initiatives, and effective communication strategies. While the study's scope is limited to attitudes within the hospitality sector, it encourages future research to explore attitudes across various professions and regions. Additionally, this calls for efforts to create a culture of inclusivity through training, mentorship, and opportunities for advancement, ensuring individuals from diverse backgrounds can thrive. The researchers challenge future researchers to address gaps identified in the study and extend their investigations to gain insights from different perspectives and regions, ultimately contributing to a more equitable and prosperous future.

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# **I am PREPared: Using the Point-Reason-Example-Point Method to Improve Skills in Writing Structured Essays**

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## **KEYWORDS:**

- **Essay Writing**
- **Essay Structure**
- **Introduction, Body, Conclusion Format**
- **Point-Reason-Example-Point Method**
- **Writing Intervention**

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**Abstract.** The tripartite division of the structure of the essay involves the: Introduction, Body, and Conclusion. Students are well-exposed both to essay writing activities and this standard format. However, the researchers observed that some of their Grade 7 Students failed to develop well-written short compositions. Specifically, they were struggling with the structure of their outputs following the Introduction, Body, and Conclusion format. To address

this concerning observation, the researchers introduced the Point-Reason-Example-Point Method as a writing guide for learners which targeted the writing errors and mistakes perceived from their previous essays. Thus, in this intervention,

the participants were facilitated to write essays using the essay writing method, and they were asked about their perceptions and experiences upon using it.

With these in mind, a document analysis through coding sheets was

utilized to identify how the proposed solution specifically helped students in structuring their essays. Additionally, one-on-one interviews with the participants were conducted, in which the results underwent theme clustering to examine their thoughts and experiences using the said guide. The findings revealed that the proposed writing intervention refined the structure of the essays. Initially, they scored 2.57 (Average) in their previous essays. After the intervention, they scored 4.39 (Good). Meanwhile, the participants shared that the introduced strategy was indeed useful and easy to use with. Therefore, they desired to continuously use it for their writing tasks. In conclusion, the Point-Reason-Example- Point Method is discovered as an effective strategy to assist learners in converting their ideas to well-structured essays.



## **I am PREPared: Using the Point-Reason-Example-Point Method to Improve Skills in Writing Structured Essays**

Students are naturally challenged in writing, especially in languages other than their native tongue. According to Mantra and Widiastuti (2019), among the four macro skills, writing is considered as one of the most challenging and complicated tasks for learners to perform particularly when they have to write in a second or foreign language. As defined by Al-Atabi (2020), writing is the process of using symbols, letters of the alphabet, punctuation, and spaces to communicate thoughts and ideas in a readable form; and it is a medium of human communication that involves the representation of a language with symbols. In schools, students are being taught how to nurture their writing skills, especially through actual writing activities such as constructing academic essays. Academic essay is a type of writing that has a defined structure: an introduction, body, and conclusion. Writing academic essays is an essential skill for any student; and the ability to produce clear, well-argued essays is fundamental to good coursework and written exams.

However, many Junior High School Students are struggling to construct their essays using the proper format as what have been observed by the researchers themselves when they handled Grade 7 classes in one of the campuses of Immaculate Conception Academy (ICA) during their Field Studies. This is despite the fact that students are being taught and guided when it comes to constructing essays using the standard format: the IBC or Introduction-Body-and-Conclusion format. To enumerate, students' have submitted written outputs in English, in which the researchers have traced that learners make the following common mistakes and errors: unable to mention the context of the prompt, unable to respond to the prompt, unable to elaborate the ideas with reasoning, cite

examples, unable to restate the main idea to conclude the paper with finality, unable to demonstrate coherence, and unable to express complete thoughts. These are all extracted from some of the actual written essays of the said learners which reveal how such issues refrain students from producing well-written essays. This is a problem perceived by the researchers, for poorly written essays hinder teachers in fulfilling the very purposes of writing essays in the teaching-learning process namely: assessing the learning of the students about the topic, activating their higher-order thinking skills through writing for better learning experience, and knowing their students better through their expressed written thoughts.

Therefore, the researchers introduced a writing strategy to assist learners in addressing these problems, in which they carefully examined the identified common writing mistakes that they eventually developed as a complete rubric. Moreover, the IBC format was also considered during the development process to make the criteria more reliable. With that, they modified the PREP or Point- Reason-Example-Point Method to be an essay writing guide for learners. Using this technique, students could learn how to utilize a convenient and acceptable pattern in developing and expressing ideas during essay writing activities. Although it was originally being used as an effective guide for delivering impromptu speeches, the researchers remarked its potential to aid learners in writing well- structured compositions as well given its easy-to-follow pattern—in the same way it had been helping not only learners, but also other individuals who aspired to overcome their public speaking difficulties.

### **Action Research Questions**

This study aimed to enhance the skills of Grade 7 Students in writing structured essays. With this in mind, the study sought to answer the following questions:

1. How does the PREP (Point-Reason-Example-Point) method improve students' ability to structure their essays?

2. What are the students' perceptions and experiences in using the PREP method?

### **Proposed Innovation, Intervention and Strategy**

The intervention was implemented to address the issues concerning the development of the essay structure through the utilization of the PREP method. To be particular, it targeted to assist the Grade 7 Students from one of the campuses of Immaculate Conception Academy. The researchers observed that there were some of them who were struggling to demonstrate the needed competencies for writing essays.

The PREP method is composed of four parts namely: Point, Reason, Example, and Point. These parts are parallel to the standard writing format: the Introduction-Body-Conclusion (IBC) format. The former is a flexible guide for it could be employed in long and short essays, in contrast to the IBC format which serves its best purpose in essays that have at least five paragraphs. This standard length makes the IBC format appear complicated to use in shorter compositions, which eventually brought about problems in structuring essays—the focus of this study.

To elaborate the said strategy, the Point—the first part of the PREP—functions as the Introduction of the essay. Since essay prompts are being given prior to the essay writing process, the Point aims to respond to these accordingly. So, if the prompt is a question, the Point must indicate the answer to the question. This is the counterpart of the most important sentence of the Introduction: the thesis. Thus, the Point answers the question: "What is your major claim in the topic?"

Next are the Reason and Example. To detail the Reason, the students must proceed with providing an elaboration of the established major claim of the essay. This is followed by the Example part wherein the learners must cite an example or

example scenario wherein the Point and Reason could be observed. These are the equivalents of the Body paragraphs in IBC.

Finally, another Point must be included to complete the essay. But this time, it must be anchored to the first Point for it contains the reiteration of the main idea stated in the initial part. This is the echo of the Conclusion in IBC.

The actual utilization of the intervention was divided into three phases. In the first phase, the said strategy and the process of employing it were introduced to learners. This was done by facilitating a discussion on how to use the PREP format in writing essays. This took one session of their English class.

Then, in the second phase, a formal English lesson was delivered in the next meeting. As part of the formative assessment of the lesson, the students were instructed to write essays related to the topic, in which they employed the PREP method. This was conducted onsite to ensure that the learners were guided by the Practice Teacher during the actual writing process and the implementation of the proposed intervention. The written essays that were constructed by the students were evaluated based on an essay writing rubric provided by the Practice Teacher.

These steps were administered four times all throughout the second phase. To be exact, these were facilitated twice a week for two weeks. After the given period, the essays were scrutinized and evaluated with the aid of a rubric, which were anchored on the common writing mistakes and errors that had been identified by the researchers in students' previous English essays.

Meanwhile, during the third and final phase, interviews were facilitated with the students to gather their individual perspectives on the application of the PREP method in essay composition. This process aimed to allow students to articulate their individual reflections, experiences, and perceptions

regarding the utilization of the PREP method in their essay composition endeavors. Subsequently, their feedback and opinions were meticulously compiled and analyzed to ascertain insights into the efficacy and reception of the PREP method within the academic context

## **Methodology**

This study is an action research in nature which combines research and solution implementation in context to address a particular problem in an educational setting. Stringer (2019) emphasized the necessity of considering the inherent diversity of experiences and perspectives within every classroom or school environment, laying the groundwork for more effective and sustainable change. This method made it possible to quickly respond to issues that could be perceived in the classroom. In this study, the researchers operated a document analysis, specifically using coding sheets, wherein the essays that were constructed by the learners were examined by the researchers. Data were classified according to codes or themes that summarized the results of the data gathering. Additionally, insights that were gathered from interviews were presented as well to further enrich the results of the data analysis process.

## **Participants and/or Other Sources of Data and Information**

The study focused on five Grade 7 students from one of the ICA campuses. They were considered in this action research because of their observed struggles in structuring essays in their English subject. The said students were also the interviewees in gathering data for the analysis of their perceptions and experiences upon using the PREP method as a writing intervention.

## **Data Gathering Methods**

Firstly, the researchers wrote a letter to the School Principal of the ICA selected campus asking for the academy's permission to conduct research with their students. An informed consent was provided to the participants in which their rights to participate and not to participate in the study were acknowledged. As the involved parties agreed to take part in the actual conduct of the study, the participants were asked to write essays related to the topics discussed to them for their English classes during the utilization of the proposed intervention. This set of steps took a total of two weeks to be accomplished. Afterwards, the essays were subject to evaluation using a rubric. Finally, they were interviewed to explore their perceptions and experiences upon using the PREP method. Therefore, an interview questionnaire was developed accordingly. Insights were analyzed to enhance the designed intervention. The data, which will be gathered, were secured for this study's procedures only, including the identity of the learners as mandated in the Republic Act No. 10173, also known as the Data Privacy Act of 2012.

## **Data Analysis Plan**

For the data analysis plan, the researchers used coding sheets for the document analysis of the participants' written essays, and thematic analysis to examine the results of the interview. To analyze the first form of the data gathered—which were written essays of the participants—a validated rubric was employed to evaluate the outputs of learners during the writing activities before and after the application of the proposed strategy. The said rubric included the mistakes and errors in students' written essays which were categorized based on the common and standard indicators or requirements in writing proper essays. These were translated into codes which were organized through coding sheets, so the results of the entire implementation of the PREP method were organized, consolidated, and compared. Furthermore, to specifically

determine how the PREP method improved writing skills, the actual written essays were scored in accordance with the individual criterion in the validated rubric. This stage verified if the participants' writing skills had been enhanced across different components of the writing process. Finally, a thematic analysis of the perceptions and experiences of learners while using the intervention was initiated wherein their ideas were classified as themes that summarized their insights.

### **Ethical Consideration**

This study had undergone review by the Emilio Aguinaldo College-Cavite Ethics Review Committee. After thorough discussions of the nature and process of this research, the said committee granted the researchers an approval to conduct their investigation with the EACC ERC Code: 2024-02-075. The certificate is attached in the appendices.

### **Discussion**

The researchers utilized coding sheets to respond to the first research question: **"How does the PREP (Point-Reason-Example-Point) method improve students' ability to structure their essays?"** The purpose of the sheets was to organize and specify the development of the participants in different areas of their writing process according to structure. The consolidated results and discussion are presented below.

Table 1

*Consolidated Scores from Pre-PREP and After the four-phase  
PREP Intervention*

Criteria in Structuring Essays	Pre-PREP		After Intervention	
Introduction				
1. Context of the Prompt	2.4	Poor	4.25	Good
2. Response to the Prompt	4	Good	4.65	Excellent
Body				
3. Elaboration of the Main Idea	2.2	Poor	4.4	Good
4. Citing Examples	2.4	Poor	4.25	Good
Conclusion				
5. Reiteration of the Main Idea	2	Poor	4.5	Excellent
Organization				
6. Demonstration of Coherence	2.4	Poor	4.25	Good
TOTAL MEAN:	2.57	Average	4.39	Good
<b>Legend</b>	Excellent 4.51 - 5.00	Good 3.51 - 4.50	Average 2.51 - 3.50	Poor 2.00- 2.50

The researchers utilized a document analysis—the process of interpreting documents for an assessment topic by the researcher as a means of giving meaning to the results of the research procedures. In which, the data gathered may also be scored using a rubric in determining mean values for each criterion in the essay rubric, identifying six criteria across four



categories. With this in mind, the table above presented the consolidated scores of all the essays written by the participants before and after the intervention. The said scores were obtained based on the provided criteria in the rubric.

Under the criterion for the Reiteration of the Main Idea, the participants gain an average score of 2.00 (Poor)—the lowest score remarked in the pre-PREP stage. But after using the intervention, the participants display the most improvement in this area with an average score of 4.5 (Excellent). Prior to the implementation of the writing technique, it was observed by the researchers upon checking the essays of the participants that the conclusion part of the essay was not developed at all. To detail, no succeeding sentences could be found in their compositions after answering the essay questions. As a result, the conclusion, including the body of the essay, was not constructed.

Conclusion is an important part of the essay. Pham et al. (2022) reiterates in their study that the proper way to write it is to summarize the discussion of the entire composition using the writer's own words which may be preceded with his or her personal message to the audience. This was detected from the participants as they used the PREP. The intervention suggests that in the last part of the written outputs, students must restate the Point to reeducate the readers of what they are trying to claim to them. For this reason, they were able to mention the Point again in different words summarizing their ideas again in their concluding sentences. Moreover, they did not simply restate the main idea, but they also involved the readers with their personal message to them regarding the topic, ending the composition with the desired finality. Indeed, the PREP method helps students in ending the essay with finality using their concluding sentences.

On the other hand, the participants show the least improvement for the Response to the Prompt criterion wherein participants' initial scores are 4 (Good). In the post-intervention,

their consolidated scores increase to 4.65 (Excellent). Impressively, the participants are able to precisely respond to the given essay questions by actually answering it to explain their stand or view on the topic. Their answers were direct, accurate, and significant in their own contexts. These are all important characteristics of the Point or the thesis statement as it functions as the main argument of the written output (Chang, 2021).

The PREP method requires students to establish their Point in the very first part of their essays observing the qualities mentioned above. But since it explicitly reveals its connection to the rest of the parts of the given outline from the Reason to the Point, the participants realized the purpose of their main idea; therefore, they were able to solidify their arguments by specifying their main point with ideas that would be discussed until the latter portion of their writing. Indeed, the PREP guide helps students to produce more specific, substantial, and sound main ideas or Points.

Within the Body, particularly in constructing the Elaboration of the Main Idea, students' prior scores were 2.2 (Poor). Later on, the participants exhibit great improvement as well in this area and obtain 4.4 (Good score) after the four-phase intervention. Previously, the researchers noticed in the essays that participants did not write any explanations for their answers to the essay questions. Thus, they were not able to expound their main ideas with reliable evidence or reasoning.

Based on the PREP intervention, students are to write reasons for their claims on the second part: the Reason. It is not enough to merely state your arguments to perfectly respond to essay prompts. Instead, writers must incorporate reasons and additional information or evidence to influence the readers to accept their views (Murtadho, 2021). As a result, the ideas in the composition of the participants were no longer hanging and unsupported. Instead, after establishing their stand, they were able to reason out for having their claims using relevant and elaborative information that further explained their arguments

applying critical thinking in writing. PREP undoubtedly aids learners in establishing a good argument supported with reliable evidence or reasoning.

In the remaining criteria namely: Context of the Prompt, Citing Examples, and Demonstration of Coherence, the participants show equally great amounts of refinement after the four-phase intervention.

For the Context of the Prompt criterion, the participants previously scored 2.4 (Poor). After the application of PREP, they obtain 4.25 (Good). Before, participants did not mention details that give readers some background information on the subject matter. They just focused on giving answers to the assigned questions. After the application of PREP, participants attempted to establish the context of the prompt by describing the general topic or detailing a personal experience relevant to the claim. Doing so is important in writing the introduction. Sometimes, “it is one of the ways to convince your readers to read your written outputs” (Bulqiyah et al., 2021).

Although there was no specific area in the PREP guide that recommended learners to write the context of the prompt, the students unexpectedly learned to do so. The researchers concluded that: since learners attempted to make connections between the main point and the entire content of the essay, they inevitably put more details to the Point itself. And the more they specified their prompt with detailed information, the more they introduced the readers to the very context of the topic. This eventually reflected how well the learners had understood the subject matter. Therefore, the PREP strategy can be perceived as helpful in permitting learners to write good introductions for their essays with well-established context.

The next part was Citing Examples, in which they received a score of 2.2 (Poor), but with the aid of the PREP method, they receive 4.25 (Good) in their next essays. As

previously stated, no following sentences were perceived by the researchers. To simplify, the participants were not able to expound their arguments by enumerating examples or imagining a scenario where their arguments could be applied—great techniques in validating arguments.

In the Example part of the writing intervention, the said learners were encouraged to concretize their ideas by identifying specific examples, and narrating a true or imaginative experience, wherein they employed the concepts they had discussed in the initial parts of the essay. This is an important skill in writing that motivates students to not only present their ideas in a structured way, but also to justify and construct it logically, promoting critical thinking and active learning through writing (Bean et al., 2021). To summarize, the PREP method allows learners to use critical and active learning skills to structure their essays with sound, organized and practical judgment.

Lastly, under Organization, under the Demonstration of Coherence, participants scored 2.4 (Poor), which become 4.25 (Good) after the implementation of the proposed guide. Initially, the participants developed the ideas in their essays in isolation. To elaborate, they wrote their ideas in bullet form or in incomplete sentences, making it more confusing and incomplete in the perspective of the readers. Coherence was definitely not evident.

Upon using the PREP, they constructed complete ideas that were arranged and connected logically, sometimes using logical connectors. Crossley (2020) described these as effective strategies to engage the readers—the concept of coherence—which were utilized by the participants with the PREP method. Starting from the Point, the participants were able to consider the readers by establishing the very context of the essay topic. They mentioned the people, places, objects, and scenarios involved allowing the readers to really understand first the need to read and comprehend their written compositions. These were then proceeded with the declaration of their claims that were well-

argued in the Reason and Example sections, and ended with decent conclusions.

To emphasize, the proposed writing guide impliedly taught learners another important aspect of the writing process—the outlining. To elaborate, the researchers discovered that they literally used the method as a guide, when they vertically outline the parts: Point, Reason, Example, and Point; and allotted sufficient space for their ideas anchored in each of these parts. Iminovna (2023) recognized the ability of such outlining strategies to promote coherence as the students were being given the chance to really reflect on their writing decisions before they actually executed it. Indeed, the PREP improves students' skills in structuring essays that display coherence by being mindful of the actual writing process and the readers of their outputs.

Furthermore, specific statements from the transcriptions of the participants were chosen to determine the experiences of students in the utilization of the Point-Reason-Example-Point (PREP) Method. These statements were clustered and analyzed using Thematic Analysis, which included Textual and Structural Analysis. The researchers examined five themes answering the question **What are the students' perceptions and experiences in using the PREP method.**

Table 2

Horizontalization for the Theme: Better Organization of Ideas

Theme # 1: Better Organization of Ideas	<i>P1: It helps us organize the thoughts and ideas.</i>
	<i>P3: It's a guide for me to make an essay.</i>
	<i>P4: Sa una po nilalagay nyo lang muna po yung ideas mo, pagkatapos po nung ideas na yon mas madali na po na maglagay ka po ng words na mga paragraphs po.</i>
	<i>(At first, you will just write your ideas, after that, it is easier to put words into paragraphs.)</i>

Organization in writing essays is the arrangement of ideas, evidence, or details in a perceptible order. This enables the learners to construct a logical flow from one idea to another, although some learners struggle to organize and put their ideas and thoughts in sequence. During the interview, the participants were asked on how the PREP Method helped them to better construct their essays. Some of the verbatim of the participants are shown above.

Organization is one of the most important elements of an essay that is often overlooked. As defined by Harpiansi (2023) organization is the ability of a writer in organizing sentences into a coherent and cohesive idea. Thus, one of the factors that generally contributes to the overall quality of essay writing is organization (Li et al., 2022). Based on the participant's

responses, by following the PREP Method—they were able to construct their essays by organizing thoroughly their thoughts and ideas using the said method to make it as a guide to establish the structure and better produce a comprehensive writing.

Table 3

*Horizontalization for the Theme: Refined Main Argument*

Theme #2: Refined Main Argument	<i>P2: Yung point po para maintindihan po talaga yung essay.”</i> (It helps me to better develop the point, so that (we can) comprehend the (essay)...
	<i>P5: It makes the reader understand what I’m trying to say and trying to tell them and what I’m trying to inform too.</i>

In writing essays, the main argument must be established in the introductory part as it contains the author’s controlling point about the topic. The participants were asked how the PREP Method helped them to better construct their essays. Some of the participant’s responses are presented above.

A high-quality argumentative essay normally starts with an introduction on a topic, followed by standing a clear position on the topic and supporting the position with arguments and evidence. Then, counter–arguments with evidence to the original position and responses to the counter– arguments are presented. (Noroozi et al., 2022) Despite the fact that it is naturally challenging for the students to establish the main argument in writing essays. The participants were still able to establish a refined main argument in the introductory part which contains context and response to the prompt. As shown on the

participants’ responses, following the PREP Method helped them to develop a refined main argument, specifically on the Point which is the counterpart of the Main Argument.

Table 4

*Horizonalization for the Theme: Challenged in Providing Examples Relevant to the Prompt*

Theme # 3: Challenged in Providing Examples Relevant to the Prompt	<i>P2: Yung example po, kasi hindi ko po masyado siyang gets kung paano po siya gagamitin...”</i> (For the example, because I do not really understand how to use it...)
	<i>P4: Sometimes po sa mga topics po especially po sa mga ireresearch rin po... kailangan nyo po tingnan kung ano po yung pwedeng ilagay na example.”</i> (Sometimes in the topics especially to those you need to research...there are specific (ideas) that you may include in the example.)

In writing essays, providing examples means to show or elaborate something clearly to support a point. Therefore, giving appropriate and effective examples can be challenging. It usually depends on the subject and readers. During the interview, the participants were asked on the challenges they have encountered using the PREP Method. Some of the verbatim of the participants are displayed above.

Two among the five participants found it challenging to give examples relevant to the prompt given to them. To



elaborate, one participant was challenged because of the inability to know how to properly use examples in constructing essays. The other participant found it challenging due to the variation of topics since participants were given four different prompt questions to answer. In the study of Safarova et al. (2023) One of the challenges in writing essays is providing relevant evidence to support the arguments and ensure coherence and clarity throughout the essay to eliminate any grammatical errors and ensure that the writing effectively communicates the message towards the reader. That being said, it is undoubtedly challenging to provide examples as evidence to support a point or the main argument in writing essays.

Table 5

*Horizontalization for the Theme: Seamless Usage of the PREP Method*

Theme #4: Seamless Usage of the PREP Method	<i>P1: So far, none yet. It was really easy.</i>
	<i>P3: Okay lang po...madali po.</i> (It was okay and easy to apply.)
	<i>P5: No, nothing. I did not face any challenges.</i>

Writing is a complex activity. Finding and providing appropriate strategies in writing could help to better construct essay writing. During the interview, the participants were asked on the challenges they have encountered using the PREP Method. The verbatim of the participants are shown above.

Despite the fact that writing short essays is indeed a challenge as it requires to construct a response to an essay prompt with few telling words. Through employing appropriate

strategy, it is easier for the participants if they have an outline and guide to follow. It is recommended in the study of Oktavianti et al. (2021) to investigate more about the strategies that students could use in developing their ideas in writing essays. After the implementation of the four phases which required the participants to answer four different prompt questions, three among them did not face any challenges upon using the PREP Method.

Table 6

*Horizontalization for the Theme: Adoption of the PREP method*

Theme #5: Adoption of the PREP method	<p><i>P1: In using the PREP method, I actually think that it was really easy in making shorter essays. I will keep using the PREP method...it has made writing essays really easy for me."</i></p>
	<p><i>P2: Yung PREP na po, mas nakakatulong po siya sa paggawa ko ng essay and talagang mafocus ko po doon kung ano yung point."</i> (I choose) the PREP, since (by using it) it helps me in making essays and I can focus on (developing) the point (of the essay)</p>

#### Theme #5: Adoption of the PREP method

*P3: Naging guide ko po sya sa pag gagawa, mas napadali po yung pagsusulat ng essay. (It became my guide in writing, it became*

*easy for me to write an essay)*

*P4: Noon po magulo po talaga ako mag essay and pag ginamit ko po yung PREP method mas parang nadalian at naorganize na. Noong una mahirap sya para sa'kin, pero nung inulit-ulit ko ang paggamit nito, ito ay... naging komportable ako dito."*

*(Back then my essays were unorganized and if I used the PREP method it became easier and organized really well. It was difficult for me at first, however when I repeatedly do it, I get comfortable with it.)*

*P5: I'm going to continue using the PREP method because it's way better for me since it's easier to write and it's easy for readers to understand. It's good and I'm able to write a good essay with it."*

Students have preferences in constructing their essays in an organized and logical manner following the standard format. After employing the PREP Method, students were asked during the interview to share about their preference and reason on which method they will continue using in writing: PREP Method or the accustomed way of writing essays. The verbatim of the participants are shown above.

The study of Nenotek et al. (2020) has proved that academic writing is highly complicated. Thus, it is crucial for the teacher or lecturer who runs an academic writing course to determine the practical strategy for learning academic writing. This study supported the responses of the participants wherein

by implementing the PREP Method—they find the said writing intervention as effective in writing well-constructed essays. In previous essays, one participant shared that its structure was disorganized. After the implementation, it became easier to organize the Introduction where the context of the prompt and response to the prompt was established; elaboration of the main idea and citing examples on the Body to support the main argument; and finally, reiteration of the main idea on the Conclusion. Majority of the students' responses centered on how the PREP Method enabled them to better organize their ideas and align the structure of their writing. Thus, they preferred the PREP Method instead of their accustomed way of writing essays.

## **Conclusion**

This current study has presented the development of students' writing skills as well as their experiences upon the implementation of Point-Reason-Example-Point (PREP) Method; focusing on how they improved in writing structured essays. After the four-phase PREP intervention where the participants answered four prompt questions, it has been observed that there is an improvement with regard to the structure of their essays compared to their pre-PREP essay. Students' development focuses on how they properly follow the criteria in writing structured essays namely: Context of the Prompt, Response to the Prompt, Elaboration of the Main Idea, Citing Examples, Reiteration of the Main Idea, and Demonstration of Coherence. Specifically in writing the Conclusion part wherein the participants reiterated the main idea—from gaining a poor indicator—they accumulated a high average score indicating that they showed excellence in writing the latter part of the essay. This implies that after the implementation of the intervention, participants were able to provide a written composition to a logical end which showed the effectiveness of using the PREP Method. Moreover, it can be a helpful tool for students in writing enhanced conclusions.

## **Recommendation**

The PREP Method was deemed effective when it came to improving students' writing skills with regard to the structure. It can assist them to better present their already existing learnings in their writing tasks. Particularly, it is a great strategy to teach students how to build the context of their writing compositions, use critical thinking and reasoning skills to support arguments, concretize one's claims with examples, and conclude essays with finality. Moreover, the PREP method is also discovered as a helpful tool in nurturing outlining skills that are essential in any writing process. Therefore, the researchers encourage language teachers and those who are teaching other subject areas to introduce the PREP writing guide to their learners as well. As a result, teachers may accurately assess the actual learnings of the students that are not properly exhibited due to writing difficulties.

## **Overall Essence**

Writing is the last skill one could learn in the four macro skills. Thus, making it the most complex. In line with the curriculum, students in the secondary level, specifically Grade 7 students are expected to compose various essay writings. However, the researchers have observed that there are learning gaps when it comes to students' ability in writing structured essays that is evident in their previous essay compositions. This action research served as an immediate response to address this academic challenge. The writing intervention employed was the Point-Reason-Example-Point (PREP) Method. The application of PREP Method aided students in elaborating ideas, expounding them, identifying specific examples, and writing concluding sentences—presenting ideas that are logically connected. In essence, the adoption of PREP and the findings of this study established a contribution to the educational sector in improving the students' writing skills.

## **Plans for Dissemination and Utilization**

The researchers presented and discussed the study which focused on students' competencies in constructing and writing essays in the institution-based research colloquium. In the same institution—the School of Education—the study was reviewed and approved. As a result, copies were provided to the School of Education, EAC-C's Library, and the Research Development Office with which they were collaborating so that the findings could be utilized and maximized through an in-depth analysis of academic discussion of students' essay writing skills. In order to maximize the aim of the research findings, this study was also anticipated to be published and presented at various research colloquiums involving the research locale and other interested organizations. Public publishing will also be considered.

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# **The Effectiveness of Blue Light Vis-À-Vis Regular Light Therapy in Decreasing Systolic Blood Pressure Among Healthy Adult Females in Dasmariñas City, Cavite**

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## **KEYWORDS:**

- hypertension
- nitric oxide
- monochromatic blue light
- light therapy
- LED

**Abstract.** Hypertension is an easily treatable condition through accessible medications and healthy lifestyle. However, there are still significant gaps in its management, and one factor to look at is the increasing price of medications. According to the Philippine Society of Hypertension, the Philippines' highest mortality rate since post-

WWII was caused by hypertension, resulting in 32,614 deaths in 2021. To overcome this public concern, the researchers intended to investigate a supplementary and cost-effective approach to blood pressure reduction, particularly blue light therapy. Blue light, like sunlight, stimulates the production of nitric oxide in the skin, a

vasodilator that helps reduce blood pressure. The purpose of this study was to determine if exposure to monochromatic blue light may lower systolic blood pressure (SBP) in healthy Filipino females in Dasmarinas, Cavite, aged 25 to 50. The participants were randomly assigned to experimental and control groups, and each spent 30 minutes in a room illuminated with blue light or regular light, respectively. Participants exercised using a pedal machine at a pace of 30 steps per minute for 10 minutes before entering their designated rooms to mimic an increased blood pressure. The participant's blood pressure was measured after the workout and after resting in the room. Using t statistics, data analysis revealed a significant difference in posttest scores between the control group (Mean=120; SD=6.39) and the experimental group (Mean=116; SD=6.23),  $p=0.03$ . Thus, the results of this study suggest that 30 minutes of exposure to LED blue light at a distance of 50 centimeters from the skin could reduce SBP by 4 mmHg.

## **The Effectiveness of Blue Light Vis-À-Vis Regular Light Therapy in Decreasing Systolic Blood Pressure Among Healthy Adult Females in Dasmariñas City, Cavite**

### **INTRODUCTION**

#### ***Background of the Study***

In Greek mythology, Apollo, the god of the sun, can be seen across the sky riding a chariot pulled by blazing horses that illuminates the world with light that sustains life, presently comparable to the sun. Moreover, the ancient Greeks and Romans also depict him as the god of medicine and healing—but also the bringer and reliever of plagues. Just like what Apollo could do, modern science has come to a similar conclusion that the sun can offer favorable and adverse impacts on one's health. One of the fascinating scientific discoveries to date is that UV light increases the production of nitric oxide in the skin, which implies that solar ultraviolet radiation may lower blood pressure (Weller et al., 2020). According to the Barcelona Institute for Global Health (2022), 12.8% of global fatalities yearly, which accounts for 7.5 million deaths, are attributable to hypertension, making it one of the primary causes of mortality. In fact, only 1 in 5 adults (21%) with hypertension can control their blood pressure (World Health Organization, 2021). In a press release by the Philippine Society of Hypertension (2022), it was highlighted that hypertension significantly contributed to the Philippines' highest death rate since the post-World War II era, with 32,614 deaths reported in 2021 (Commission on Population and Development, 2022). Although hypertension is an easily treatable condition through low-cost drugs and a healthy lifestyle, there are still substantial gaps in diagnosis and treatment.

As mentioned above, UV radiation from the sun has been discovered to lower blood pressure. A study published in the *Journal of Investigative Dermatology* indicates that exposure to sunlight can help reduce blood pressure. According to Martin

Feelisch, an experimental medicine professor at the University of Southampton, nitric oxide and its breakdown products, which are present in the skin in high amounts, control blood pressure. When the skin is exposed to sunlight, nitric oxide stored in its upper layers reacts, causing blood vessels to widen as the oxide enters the bloodstream (Feelisch, 2014, as cited in Reinberg, 2018). That, in turn, lowers blood pressure. Moreover, sunlight enables the skin to produce vitamin D. As cholesterol is used for vitamin D synthesis, its levels decrease as more vitamin D is produced. However, ultraviolet rays from the sun can induce harm to the skin, eyes, and immune system (Johns Hopkins Medicine, 2021). Chakraborty et al. (2017) pointed out that the depletion of the ozone layer has. Due to the fact that sunlight generates blue light and that UV radiation from the sun is known to have harmful effects, researchers from the European Society of Cardiology investigated in 2018 the biological consequences of visible blue light that are not carcinogenic. It was revealed from the preclinical results that visible blue light, such as LED lights, induces noncancerous risk, only vision problems at most, which can be prevented by wearing eye protection. Moreover, They also examined whether exposure to blue light without UV rays could lower blood pressure in healthy individuals. After replicating the intensity of sunlight exposure with blue light, they discovered that exposure to visible blue light across the entire body reduced blood pressure by up to 8 millimeters of mercury. While this is a promising and safe way to lower blood pressure without causing any side effects, further studies shall be pursued as this is the only published study to date about the effectiveness of blue light in lowering blood pressure. Furthermore, the existing research only included healthy male Caucasian males in the age range of 30 to 60. To assess the cardiovascular preventive benefits of blue light exposure more effectively, a broader and more representative sample from the general population needs to be utilized, as the current study only involved 14 subjects.

Considering those above, and since gender, age and race disparities could influence health outcomes, this study will be conducted with the primary endpoint of determining the effectiveness of exposure to monochromatic blue light in lowering blood pressure, but with few modifications. This study will focus on healthy Filipino women aged 25 to 50 and will be applied to a larger sample to produce generalized results. The data that will be gathered and analyzed in this study aims to produce an evidence-

based alternative and cost-effective approach to treating hypertension and related diseases. If blue light therapy is further proven effective in lowering blood pressure, this will significantly contribute to medical knowledge, especially in alternative and supplementary medicine. After all, the goal of nursing professionals is to promote everyone's health and well-being, which could be done through research. An extensive body of information is produced through nursing research that helps to develop nursing practice. The results of this scientific inquiry could have significant implications for global healthcare and health policy, representing the primary objective of the study.

### ***Objectives of the Study***

The objective of this experimental study was to determine the efficacy of blue light therapy in reducing the systolic blood pressure of healthy adult females residing in Dasmaríñas, Cavite. In this study, blue light therapy was defined as a type of light treatment that uses light ranging 380 to 500 nanometers.

Particularly, this study sought answers to the following questions:

1. What is the systolic blood pressure of the control group before and after the intervention?
2. What is the systolic blood pressure of the experimental group before and after the intervention?
3. What are the mean scores of the controlled group before and after the intervention?
4. What are the mean scores of the experimental group before and after the intervention?
5. Is there a significant difference between the pretest and posttest scores of the experimental group before and after the intervention?
6. Is there a significant difference between the post-test scores of the experimental and controlled groups after the intervention?

### ***Theoretical Framework***

This study drew theoretical propositions from the Environmental Theory of Florence Nightingale and the Theory of Color Perception of Kurt Goldstein.

**Environmental Theory.** In this theory, Nightingale (1860) stated that nature has some principles that, when applied suitably to individuals, allow those who are ill to restore health and those who are well to maintain and promote health. One of the assumptions of this model is that environmental factors are necessary to obtain a healthy environment, as they are fundamental for healing. One of these environmental factors is light. Nightingale, in particular, believed that those who were sick needed light, and direct sunlight was what patients desired. Since then, Nightingale was right, as countless studies have demonstrated: sunshine plays a crucial role in maintaining human health and well-being. Patients recuperate more quickly in rooms with views of the outdoors and natural light. Also, natural light has been shown to lower heart rate and blood pressure (Lockley, 2022). In the present era, humans are already dealing with environmental problems. With the idea of supplying light, the light from the sun today is proven to be detrimental due to the depletion of the Earth's ozone layer. Exposing the patient to direct sunlight might harm their health more than good (Gonzalo, 2014). Thus, the present study focuses on blue light therapy could serve as an alternative or solution and a new healthy environment for people since the parameters and variables can be balanced or manipulated according to their health needs. The purpose of the current study is to ascertain the impact of monochromatic blue light exposure on the health and vital signs of the patient, with a focus on its ability to decrease blood pressure, given the utility of light.

**Theory of Color Perception.** Goldstein (1942) explained that certain colors cause consistent physiological responses, such as emotional experience, cognitive orientation, and overt behavior. According to this theory, which used red, green, and white room conditions, subjects in the red room condition scored more highly on stress scales than those in the green or white room conditions. Therefore, the results indicate that environmental color significantly influences how stress is perceived. The theory of Goldstein concludes that a particular environmental color influences a person's stress levels. Since the environment is commonly overlooked as a cause of emotional states, identifying the sources of life stress is vital for everyone. Considering that responses to color are both physiological and psychological, this study aims to determine if blue light therapy has a calming effect and can lower an individual's blood pressure.

## **Conceptual Framework**

Figure 1 illustrates the I-P-O framework that was utilized in this study. This conceptual framework served as the blueprint of the study, which presented the overall plan wherein, from the systolic blood pressure of healthy female participants, the measured systolic blood pressure after exposure to monochromatic blue light was interpreted.

The input is composed of the respondent's systolic blood pressure. This was gathered by measuring their blood pressure using a sphygmomanometer. The research process includes (1) exposing the participants to monochromatic blue light and regular light, (2) measuring their blood pressure, (3) collection of data based on the intervention, and (4) statistical evaluation and data interpretation. The results of this study indicated how blue light treatment and monochromatic blue light exposure affected the participants' systolic blood pressure.

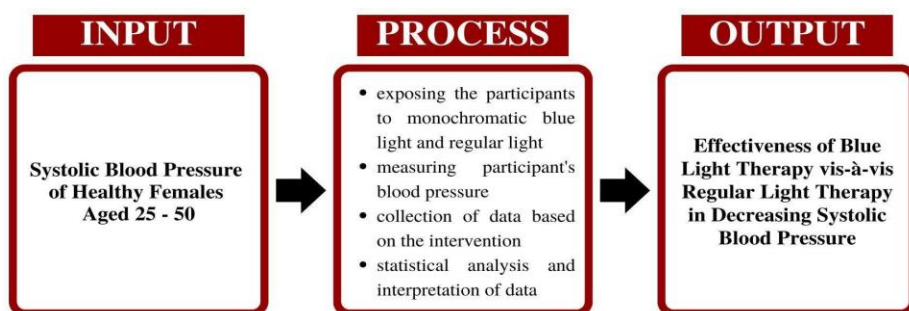


Figure 1. Conceptual Model of the Study

## **Hypotheses of the Study**

**H<sub>1</sub> (Alternative):** There is a significant difference between the blood pressure of the experimental and controlled group after the intervention.

**H<sub>0</sub> (Null):** There is no significant difference between blood pressure of the experimental and controlled group after the intervention.



## **Review of Related Literature**

### **Foreign Literature**

#### *The Sun and Its Benefits: A Bright Spot for Human Health*

A planetary system is composed of gravitationally bound non-stellar astronomical or celestial objects that revolve around a star. The Earth, the only known life-harboring astronomical object to date, revolves around a star called the Sun. The Sun, as defined by the National Aeronautics and Space Administration (2018), is a hot glowing ball at the center of the solar system made of hydrogen and helium that has been around since 4.5 billion years ago. The sun has a significant impact on our world. It regulates the seasons, climate, ocean flows, and weather, and makes life possible for all living things. Life on Earth would not be possible without the sun's heat and light (National Geographic, 2016). Aside from its environmental benefits, the Sun also significantly affects health and well-being. One of its key advantages is that it helps maintain vitamin D levels, which are necessary for bone health and immune system regulation (Hall, 2022). Additionally, sunshine controls circadian rhythm by instructing the body to raise and lower melatonin levels, a sleep-inducing hormone (Peterson, 2017). Moreover, according to Nall (2019), the release of a hormone from the brain called serotonin is known to increase with sun exposure. Serotonin has been linked to mood elevation, calming effects, and increased mental clarity. Aside from that, studies have shown that sunlight is the most effective method for breaking down bilirubin. As a matter of fact, one hour of sunlight exposure corresponds to six hours under specialized bilirubin lights in hospitals (The Birth Center Client Manual, 2016).

There are still numerous health benefits that the Sun could offer, but one of the most significant findings to date is about the Sun's ability to lower blood pressure. According to recent findings, more time outdoors under the sun may lower blood pressure. In an article authored by Hinck (2018), it was mentioned that sunlight interacts with the reservoir of nitric oxide in the outer layers of the skin, leading to the oxide's release into the bloodstream and dilation of blood vessels, consequently reducing blood pressure.

## **Local Literature**

### ***Skin Cancer and Solar UV Radiation***

Ultraviolet phototherapy is a successful treatment for hypertension, but its impact on the risk of skin cancer is still debatable. UVA, UVB, and UVC rays are the three light wavelengths that are emitted by the sun. While all release radiation, there is a delicate balance between a wavelength's capacity for healing and its potential to cause skin cancer. As a matter of fact, in the Philippines, the Department of Health has issued warnings to the general public about excessive sun exposure since it can result in catastrophic medical conditions (Miasco, 2018). The state meteorological service has warned the public about the dangers of hot weather as the country continues to experience record temperatures. The Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA) advised people to stay inside as much as they can and to keep hydrated during the intense heat (Baclig, 2021). Dagupan, Pangasinan, known as one of the hottest places in the Philippines, recorded the highest heat index for two consecutive years (2021-2022). The temperature soared to a high level of 53° Celsius in May 2021, and as 2022 drew near, it increased to a scorching 55° Celsius on May 2, 2022, and recently, a dangerously high temperature of 54.39 Celsius was recorded on April 20, 2022 (Visperas, 2022).

Aside from that, ultraviolet exposure from the sun also poses threats to the skin. Most skin malignancies are brought on by prolonged exposure to solar ultraviolet radiation. The skin's DNA is harmed by UV radiation from sunshine, which causes cancerous cell proliferation. Skin cancer risk is also increased by sunburn. According to Perpetual Help Medical Center (2022), whereas 86% of melanomas are caused by intense exposure, approximately 90% of non-melanoma skin cancers are generated by intermittent and cumulative long-term sun exposure. Between 2011 and 2021, the Philippine Dermatological Society reported 2102 cases of basal cell carcinomas and 614 cases of squamous cell carcinomas (Tan, 2022). The detrimental effects of ultraviolet exposure are caused by the ozone layer's depletion and climate change. For some time, scientists have been expressing concern that the risks associated with hot weather are rising due to the rise in the global average temperature brought on by the increased atmospheric concentration of greenhouse gasses. Moreover, the

reduction of the ozone layer leads to heightened UV-B radiation reaching the Earth's surface, thereby directly impacting living organisms. As a result, exposure to sunlight to achieve significant health benefits has been a concern because of the associated risks brought by harmful ultraviolet radiation.

### *Hypertension Prevalence in the Philippines*

The term “high blood” is frequently used and heard in conversation in the Philippines. When used in a context, it conveys feelings of anger and exasperation. Scientifically, high blood pressure occurs when blood is pumped with greater force, leading to hypertension (National Nutrition Council, 2020). On the other hand, there are four identified causes of hypertension among Filipinos. The first is the genetic factor which can contribute to the risk of developing hypertension. The next factor is heat or hot weather, and it is believed that high temperatures might trigger episodes of hypertension by causing blood to heat up or boil. Likewise, stress, including physical and emotional stressors, can cause blood to rise. Moreover, certain meals can increase blood pressure by making blood thicker and viscous (Lasco et al., 2020).

Meanwhile, the prevalence of hypertension has steadily risen worldwide, with an escalating occurrence in low to middle-income nations. Due to the Philippines being categorized as a third-world country with low economic growth and high levels of population growth, it is evident that illness and mortality are widespread, and hypertension is one of the leading causes (Ona et al., 2021). Similarly, Diaz (2022) indicates that high blood pressure is a significant contributor to global health issues, and death is anticipated to increase over the next decade. Thus, preventive efforts are definitely needed mainly in the Philippines. Moreover, according to a report from Philippine Heart Association (2021), hypertension among Filipinos has risen to 37 percent. Among men, the prevalence was 52 percent, while among women it was 48 percent. It was substantially more common in the elderly, at 72 percent among adolescents aged 12-18, which was 5 percent. Furthermore, according to data from the Philippine Statistical Authority (PSA) as of March 2022, hypertensive disease was the fifth leading cause of death in the Philippines,

accounting for 2,565 deaths, or 5.9 percent of all deaths recorded from January to February 2022 (Baclig, 2022).

Furthermore, the control and management of hypertension is a problem in the Philippines despite implementing health access programs. Poor adherence to pharmacological and lifestyle management are known complications associated with hypertension. It is reported in clinical practice that patient adherence is low, even with the proven efficacy of antihypertensive drugs and the enactment of health education (Gutierrez et al., 2021). Indeed, the control rates for hypertension remain disappointing, particularly in the Philippines. As urged by the Department of Health (2020), different measures for hypertension prevention, treatment, and control must be aggressively pursued in order to promote awareness and ensure that hypertension will be attended to in the Philippines. On that count, an effective and efficient intervention is necessary to achieve this goal.

## ***Review of Related Studies***

### ***Foreign Studies***

#### ***Epidemiology and Global Burden of Hypertension***

Globally, hypertension is considered a silent killer. This condition is defined by a persistently higher pressure in the blood vessels, as stated by Han et al. (2020). Most patients only find out they have it after being hospitalized for a different disease or undergoing pre-employment or pre-operative medical examinations. At this rate, hypertension can already be classified as a hidden epidemic. Over the last four decades, the global average blood pressure has steadied or decreased slightly, owing mostly to the widespread use of antihypertensive medications. Mills et al. (2021) find that the prevalence of hypertension has risen, particularly in low- and middle-income nations. Hypertension affects about 108 million persons and is a significant risk factor for a variety of noncommunicable diseases. Thus, it is important to recognize and intervene in aspects related to hypertension incidence, development, and therapy (Ali et al., 2021).

Over the last three decades, the number of adults aged 30-79 years with hypertension has more than quadrupled, rising

from approximately 331 million women and 317 million men in 1990 to 626 million women and 652 million men by 2019. This expansion has primarily occurred in low- and middle-income countries. Despite the availability of low-cost and efficient diagnostic and treatment methods, nearly half of the world's hypertensive population (41% of women and 51% of men) were ignorant of their disease in 2019. Furthermore, more than half of those diagnosed with hypertension did not receive therapy, with 53% of women and 62% of men remaining untreated (Henderson, 2021). Fewer than one in every four women and one in every five men with hypertension have their blood pressure under control, and high health-care costs are caused by low healthcare literacy, poor patient self-care, a high rate of self-medication, uneven hypertension management standards, and non-adherence to treatment plans. Fewer than one in every four women and one in every five men with hypertension were able to keep their blood pressure under control, and factors such as low health literacy, inadequate patient self-care, high rates of self-medication, inconsistent hypertension management standards, and non-adherence to prescribed treatment plans and medical regimens all contributed to high healthcare costs. The economic cost of hypertension took the lion's share of economic cost. With that, implementing cost-efficient programs for hypertension prevention and improving blood pressure control rates is crucial to conserving insufficient health resources (Sorato et al., 2022).

### *Lowering Blood Pressure Through Solar Ultraviolet Radiation*

Researchers have noted foreseeable seasonal changes in human blood pressure for years. Systolic and diastolic blood pressure are prone to peaking in the winter and troughing in the summer. While many have linked this variation to temperature changes, a study released in the *Journal of Investigative Dermatology* indicates that variations in sunlight exposure could be the underlying factor. According to Liu et al. (2014), exposing skin to sun may help lower blood pressure and the occurrence of heart attack and stroke. By controlling both temperature and dietary nitrate, the researchers looked at the effects of UVA radiation on 24 healthy volunteers, comparable to 30 minutes of midday sun exposure. The researchers discovered blood pressure decreases and variations in plasma nitrate and nitrite changes that were compatible with the release of nitric oxide from skin storage. According to the researchers, these findings

establish a mechanism for regulating systemic nitric oxide and suggest that the skin plays a part in cardiovascular homeostasis.

Similarly, in a research released in the Journal of the American Heart Association, Weller et al., (2020) evaluated blood pressure readings from more than 342,000 patients at roughly 2,200 clinics for three years beginning in January 2011. Blood pressure readings were averaged each month and compared to outdoor temperature and ultraviolet radiation records, which are also averaged monthly. When the researchers crunched the information from roughly 46 million blood pressure readings, they discovered that exposure to UV sunshine was related to reduced systolic blood pressure, independent of temperature.

In addition, Park et al. (2021) undertook an investigation to assess the influence of short-term exposure to ultraviolet radiation on the blood pressure and pulse rate of individuals deficient in vitamin D3 and classified as prehypertensive. This research comprised twenty male participants identified as prehypertensive. Blood pressure and pulse rate were assessed through 24-hour ambulatory blood pressure monitoring. The exposure to ultraviolet radiation resulted in decreases in both systolic and diastolic blood pressure as well as pulse rate throughout the entire 24-hour duration. The preliminary investigation produced encouraging findings, suggesting the merit of conducting a larger-scale trial with a control group to assess the efficacy of short-term sunlight exposure as a potential strategy for reducing blood pressure and pulse rate in prehypertensive patients deficient in 25-hydroxyvitamin D3.

### *Blue Light and Its Blood Pressure Lowering Capacity*

All the electromagnetic energy in the cosmos is collectively referred to as the electromagnetic spectrum of EM spectrum. Human vision can only detect a limited fraction of the electromagnetic spectrum, with wavelengths between 400 and 700 nm. Simply put, this group of wavelengths is referred to as a visible light. Most know that sunlight contains UV and visible light rays, which can burn or tan the skin. However. Many people are unaware that sunshine actually consists of a large variety of colored visible lights rays with varying energies. Red, orange, yellow, green, and blue light rays, as well as numerous variations of each of these colors, are all present in sunlight. The energy and wavelength of each individual light beam determine its color.

Sunlight, sometimes known as white light, is made up of the entire light spectrum light. According to Heiting (2019), blue light is typically referred to as visible light with a wavelength between 380 and 500 nm. Blue light is primarily produced by sunlight, accounting for 25% of the sun's rays (de Galvez et al., 2022). Because blue light is produced by the sun, and because of the detrimental effects of exposure to the sun, studies have emerged on using artificial blue light in lowering blood pressure.

Previous research has demonstrated that exposure to ultraviolet light can cause the skin to generate nitric oxide, which lowers blood pressure. According to Holliman et al. (2017), this quick generation of nitric oxide is caused by ultraviolet radiation, which has a wavelength between 315 and 400 nm. Furthermore, it has been shown that whole-body UV-A exposure can lower blood pressure in people both during and after exposure. Moreover, Bryk et al. (2020) investigated the circadian variations of blood pressure (BP), heart rate (HR), electrolyte excretion, and melatonin secretion in normotensive (Wistar-Kyoto) and hypertensive (SHR) rats subjected to monochromatic blue light exposure during the daytime. It was discovered that exposing Wistar-Kyoto mice to monochromatic blue light resulted in a considerable drop in nighttime and 24-hour systolic blood pressure. However, epidemiological and laboratory investigations have established that ultraviolet radiation has acute and long-term adverse health impacts on the skin, eyes, and immune system (Miligi, 2020). The localized use of ultraviolet light carries a carcinogenic risk, unlike visible light which solely impacts eyesight and can be mitigated through the use of eye protection measures. Therefore, a group of researchers investigated the potential for full-body exposure to visible blue light to have comparable effects on reducing blood pressure and enhancing endothelial function in individuals without underlying health conditions. In a randomized controlled trial conducted by Stern et al. (2018), 14 healthy Caucasian males were subjected to full-body exposure to blue light for 30 minutes, with a wavelength of approximately 450 nanometers—equivalent to a daily sunlight dosage—followed by exposure to a control light on a separate occasion. Prior to, during, and for up to two hours post-exposure to both light conditions, the participants' blood pressure, arterial stiffness, vascular dilation, and plasma levels of nitric oxide reserves were evaluated to ascertain the efficacy of blue irradiation. The research findings

indicated that exposure to full-body blue light led to a reduction of approximately eight mmHg in participants' systolic blood pressure.

## **Local Studies**

### *Cost-Related Anti-Hypertensive Medication Non-Adherence*

The leading cause of mortality in the Philippines is heart and vascular diseases. The main controllable risk factor is high blood pressure which affects 28% of the population and is managed in 20% of cases. Although medication is effective in treating illnesses, many people, particularly Filipinos, do not consistently adhere to their prescribed medications, with adherence rates as low as 66%. While there is literature on the factors influencing medication compliance among Filipinos, there is a lack of research evaluating these factors (Gutierrez et al., 2021). According to a study by Sison et al. (2022), the prevalence of cardiovascular diseases in the Philippines, based on a survey conducted by the Philippine Heart Association among both hospital-based populations, indicates that hypertension is the most common at 38.6%, followed by stroke at 30%, coronary artery disease (CAD) at 17.5%, and heart failure at 10.4%. For more than thirty years, hypertension has been the primary reason for cardiovascular-related deaths in the Philippines, with socioeconomic factors being identified as one of the contributing factors. A research study has been carried out to assess the socioeconomic implications of hypertension in the Philippines for the next three decades. The projected economic burden of hypertension is set to increase from \$1 billion in 2020 to \$1.9 billion by 2050. Over the next three decades, the societal consequences of unmanaged hypertension in the Philippines will be substantial, posing significant challenges and difficulties (Mercado-Asis et al., 2022).

Mendoza et al. (2022) report that hypertension, a significant risk factor for non-communicable diseases, remains poorly managed. Despite the availability of essential technologies and medications for its detection and treatment, hypertension continues to be a leading cause of preventable deaths in the Philippines. Controlling blood pressure is one of the top priorities for lowering the global burden of cardiovascular disease. In the Philippines, control is lacking, particularly in socioeconomically marginalized communities. In these communities, long-term adherence to antihypertensive medication has been explored, and



four distinct medication adherence patterns have been identified. Some patients became less adherent to medication as their financial resources decreased. This shed light on the wide range of medication adherence patterns observed among poor people with hypertension in the Philippines and the complex web of factors affecting their treatment choices. These findings indicate the need for cost-effective potential measures to address medication and treatment concerns (Seguin et al., 2022).

## **METHODOLOGY**

### ***Research Design***

In this study, the researchers employed a quantitative research method to test their hypotheses by inspecting and examining the relationship between the variables present in their study. Quantitative research entails the methodological investigation of phenomena by gathering measurable data and employing statistical or mathematical methodologies for analysis.

Furthermore, this study was undertaken utilizing an experimental research framework. According to Sirisilla (2022), experimental research design is a structure of protocols and methods developed to initiate experimental research through the use of a scientific approach as well as two sets of variables. This design aligns to the concept of this study as it involves manipulating an independent variable and applying it to a dependent variable to gauge its effect on the latter. The said design assisted the researchers in reaching a conclusion regarding the relationship between blue light and regular light therapy in lowering systolic blood pressure in healthy adult females.

### ***Research Locale***

This study was carried out on Don Placido Campos Avenue, Brgy. Zone II, Dasmariñas, Cavite. Dasmariñas is a highly developed city within the province of Cavite, Philippines, classified as a first-class component city. Because of its population, this city is an ideal location for conducting the study and gathering information that will benefit the researchers. According to the 2020 census of the Philippine Statistics Authority, Dasmariñas has a population of 703,141, making it the eleventh most populous city in the nation. With that, it did not become a

hindrance for the researchers to find participants for their study. Moreover, according to the report of the Region IV-A Department of Health, the city of Dasmariñas recorded 3,541 cases of hypertension in 2017—the highest among all municipalities in Cavite. This means that hypertension is prevalent in the city, and an effort shall be made to address this concern.

### ***Research Participants/Respondents/Sources of Data***

Healthy adult women are the target participants of this study. Inclusion criteria include being between the ages of 25 and 50, being in good health, and residing in Barangay Zone 2, Dasmariñas City, Cavite. Adult women who were less than 25 years old or older than 50 were excluded. Moreover, women who were in poor physical health or exhibited indications of hypertension or hypotension were excluded from participating in the study. The researchers utilized a simple random sampling method known as the fishbowl technique. In this case, the selection of participants is entirely dependent on chance or probability. A profiling survey was given to the female residents of Barangay Zone 2, Dasmariñas, Cavite, in order to determine the total population of healthy females aged 25 to 50 years. In establishing the sample size, the researchers utilized Raosoft, a tool for calculating sample sizes, with a 5% margin of error and a 95% confidence level. Once the sample size was determined, every individual within the population was allocated a distinct number, and samples were chosen through random number selection.

### ***Sampling Technique***

The participants in this study were chosen using a simple random sampling procedure. This method is used to guarantee that everyone has the same probability of being selected and that the population is fairly represented. The participants were chosen using the fishbowl method, where the researchers were assigned a number to each member of the population and drew numbers randomly to select samples. The population's health will be assessed using a 27-item International Physical Activity Questionnaire—Long Form (IPAQ-LF). This served as a profiling survey, wherein participants who were qualified based on their responses to the survey were included in the draw. Their names were assigned with a number and were written on a piece of paper that was folded and was placed in a fishbowl. The researchers

manually drew numbers until the desired sample size was reached. This practice was implemented to ensure randomization, a widely adopted approach in clinical trials and experimental studies.

### **Data Gathering Procedure**

The steps that the researchers took to carry out the study were as follows:

1. In collaboration with the school administrators, the researchers obtained permission from the Research Organization of Emilio Aguinaldo College - Cavite, specifically under the School of Nursing Department, to conduct the study.
2. Upon receiving approval, the researchers secured the instruments that were used in the study, considering their validity and reliability.
3. A letter of correspondence was sent to the authorities of the research locale to secure clearances or social licenses. Following an affirmative response, group representatives visited the locale and communicated with the heads of the barangay and health center.
4. For the selection of the participants, the initial step of the researchers is to provide an adapted profiling survey (IPAQ-LF) to the female residents in the community who are between the ages of 25 to 50. This method was used to determine whether or not the participants are healthy, as health is a criterion for the participants of this study.
5. The survey findings were organized to identify individuals who met the required criteria for the study.
6. To select the final respondents, a fishbowl draw was employed. The researchers wrote the names on slips of paper and placed them in a container. Then, it was shuffled and each slip was randomly selected one by one.
7. Upon identifying the participants, informed consent was obtained from each of them. The researchers also explained the procedure of the study and how the participants can cooperate.
8. The participants were separated into two groups, with one group allocated to the blue light room and the other to the room with controlled lighting. Before proceeding with the proposed exercise, the researchers measured and recorded the blood pressure of each participant.

9. Thereafter, all female participants engaged in using the pedal machine at a rate of 30 steps per minute for 10 minutes. Following the exercise, their blood pressure was recorded once again.
10. After the activity, the participants were exposed to the blue light room and controlled light room for 30 minutes. Following this intervention, the researchers checked and recorded the blood pressure of the participants once again.
11. The data was tabulated subsequent to measuring the participants' blood pressure both before and after they entered their assigned rooms.
12. All gathered data was encoded for statistical computation. Subsequently, presenting, analyzing, and interpreting the data constituted the concluding phase of the data collection process. All papers are only accessible to the researchers and were destroyed after the successful research study.

### ***Research Instrument***

In this study, data from participants, relevant for addressing the research question, was collected using an adjusted survey questionnaire, the International Physical Activity Questionnaire—Long Form (IPAQ-LF), as well as a stethoscope and a blood pressure measuring device.

***International Physical Activity Questionnaire - Long Form (IPAQ-LF).*** The International Physical Activity Questionnaire—Long Form (IPAQ-LF) was developed in Geneva by an International Consensus Group in 1998. The International Physical Activity Questionnaire (IPAQ) is a standardized tool developed to quantify regular physical activity levels across different populations and socio-cultural settings. The IPAQ comprises two versions - a brief version and an extended version, both requiring a 7-day recall of physical activity. The long form (LF) of the IPAQ was specifically designed to offer a detailed assessment of daily physical activities, including time spent on walking, moderate-intensity activities, and vigorous-intensity activities in various domains such as work, transportation, household chores, gardening, and recreational pursuits. The results of IPAQ can be reported in different categories, such as low, moderate, or high activity levels. In this study, this

questionnaire was adapted to determine if the participants are healthy and physically active. Only those participants who were categorized as having moderate or high activity levels are going to be part of the experiment.

**BP Apparatus and Stethoscope.** The sphygmomanometer is a tool employed for measuring blood pressure. For this research, a mercury sphygmomanometer was utilized as it is the most commonly used type of blood pressure apparatus and is considered the standard measurement tool. It consists of cuffs that are manually inflated and connected to tubes containing mercury. Additionally, a medical-grade stethoscope was utilized to listen to the blood flow through the artery, with the readings displayed on a gauge linked to the cuff. These two devices were used by the researchers to determine the blood pressure of the participants before and after entering their designated rooms.

### **Data Analysis**

Descriptive statistics were utilized to describe the blood pressure of both the experimental and control groups before and after they entered their designated rooms. For categorical data, measures of frequency were typically employed, while other measures were used for quantitative data. In this specific study, the researchers used frequency distribution. According to Anaesth (2019), frequency statistics simply count the occurrences of each variable in the sample or population.

To identify the mean scores of the experimental and control groups before and after the intervention, the researchers utilized a descriptive statistics approach. They employed the Statistical Package for the Social Sciences (SPSS), a software tool for the quantitative analysis of complex data, to determine the central tendency of the variables, specifically the mean or statistical average. The mean represented the central point of the participants' systolic blood pressure before and after the intervention, effectively summarizing the entire dataset with a single number. In this study, the participants' systolic blood pressure values were imported into SPSS, which then calculated the mean using descriptive statistics.

To determine if there was a significant difference between the pretest scores of the experimental and control groups, an

independent sample t-test was employed. A t-test is performed on a population with a normal distribution, independent data points, and a sample size of 30 or more. This method is used to determine whether the means of two populations are equal, assuming the population variance is known. In statistics, population variance is a crucial measure of dispersion, indicating how data points are  $\sigma^2 = \frac{1}{N} \sum_{i=1}^N (x_i - \mu)^2$  ughout the population. To calculate the population variance, the formula was where N is the size of the population consisting of  $x_1, x_2, \dots, x_N$  and  $\mu$  is the population mean. To calculate the mean, all the observations were summed up and then was divided to the number of observations (N). Since the pretest and posttest score of the experimental and controlled group was compared, a two sample t test was utilized to check if there is a significant difference between the means of two samples. The t test formula that was used is  $t = \frac{\bar{x}_1 - \bar{x}_2}{s \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$ . To specify, t is the t value,  $\bar{x}_1$  and  $\bar{x}_2$  are the means of the two groups being compared, s is the pooled standard error of the two groups, and  $n_1$  and  $n_2$  are the number of observations in each of the groups.

### **Ethical Consideration**

This study was subjected to a comprehensive review by the Emilio Aguinaldo College - Cavite Ethics Review Committee (EACC-ERC). The review process aimed to ensure that the study adhered to the highest ethical standards and did not present any ethical concerns or violations. After a thorough evaluation by the EACC-ERC members, the research protocol was granted approval. The Ethics Review Certification confirms that the study complies with ethical guidelines and safeguards the welfare and rights of all participants involved. The review process concluded that the study was free from ethical issues, thereby permitting the research to proceed. The Institutional Ethics Review Board has assigned the clearance number 2023-01-040 to this approved protocol. This clearance serves as an official endorsement of the study's ethical integrity and compliance with institutional and regulatory standards. The decision of the Institutional Ethics Review Board underscores the commitment to ethical research practices, ensuring that the study is conducted responsibly and with due consideration for the participants' safety and well-being.

## RESULTS

### **Presentation of Data**

**Table 1. SBP of Control Group Before and After Exposure to Regular Light**

Code	Before	After	Code	Before	After	Code	Before	After	Code	Before	After
C01	130	120	C11	130	120	C21	130	120	C31	130	130
C02	130	130	C12	130	120	C22	130	120	C32	130	110
C03	120	130	C13	130	120	C23	130	120	C33	120	120
C04	130	120	C14	130	120	C24	120	120	C34	120	110
C05	130	120	C15	120	130	C25	120	110	C35	130	110
C06	120	110	C16	120	130	C26	120	120	C36	120	120
C07	130	110	C17	120	120	C27	120	110	C37	130	120
C08	120	120	C18	130	130	C28	120	120	C38	120	120
C09	130	120	C19	120	120	C29	120	120	C39	130	110
C10	120	110	C20	130	120	C30	120	120	C40	130	130

Table 1 shows the measured systolic blood pressure of the participants from the controlled group before and after being exposed in a room with a regular light. It can be seen that the systolic blood pressure of the participants prior to being exposed in their assigned room ranges from 120 mmHg to 130 mmHg. On the other hand, the systolic blood pressure of the controlled group after exposure to regular light ranges from 110 mmHg to 130 mmHg. Before the participants entered the room illuminated with regular light, they were first asked to perform a cardiovascular exercise using a pedal machine to increase their heart rate and respiration, and to raise their oxygen and blood flow throughout the body. The researchers had this procedure done in order to mimic an increased blood pressure among their healthy participants. After doing the exercise, the participant's systolic blood pressure was measured, then they were told to rest in a 25°C air-conditioned room with regular lighting for 30 minutes. After the allotted time, their systolic blood pressure was measured again.

**Table 2. SBP of Experimental Group Before and After  
Exposure to Blue Light**

Code	Before	After	Code	Before	After	Code	Before	After	Code	Before	After
E01	130	110	E11	120	130	E21	120	120	E31	140	120
E02	130	120	E12	130	120	E22	120	100	E32	120	130
E03	120	110	E13	120	110	E23	130	120	E33	130	120
E04	120	110	E14	120	120	E24	120	120	E34	120	110
E05	120	120	E15	120	110	E25	130	120	E35	120	120
E06	130	120	E16	130	120	E26	120	110	E36	120	110
E07	130	120	E17	130	120	E27	130	120	E37	140	120
E08	120	110	E18	120	110	E28	120	120	E38	120	110
E09	130	120	E19	120	120	E29	130	120	E39	130	120
E10	120	110	E20	130	120	E30	120	110	E40	130	110

Table 2 presents the systolic blood pressure measurements of the participants belonging to the experimental group, both prior to and following their exposure to a room illuminated with blue light. The data reveals that, initially, the average systolic blood pressure levels of the participants ranged from 120 mmHg to 140 mmHg prior to entering their designated room. Conversely, after exposure to blue light, the systolic blood pressure of the experimental group varied between 110 mmHg to 130 mmHg. To induce an increase in blood pressure among the healthy participants, they were instructed to engage in cardiovascular exercise using a pedal machine before undergoing the blue light therapy intervention. This exercise aimed to elevate their heart rate, and respiration, and improve oxygen and blood circulation throughout their bodies. Following the exercise, the participants' systolic blood pressure was measured, after which they were directed to rest in an air-conditioned room with a temperature of 25°C, featuring blue lighting, for a duration of 30 minutes. Upon completion of the designated time period, their systolic blood pressure was measured once again.



**Table 3. Mean Systolic Pressure of the Control Group**

	Mean	SD	Interpretation
Pretest	125	5.06	High
Posttest	120	6.39	Normal

Table 3 shows the mean scores of the control group before and after the intervention. As shown in the table, the control group obtained a mean score of 125 mmHg before resting in a room with regular lighting. Since the participant's blood pressure was heightened due to the cardiovascular exercise that they did, an above-normal blood pressure was recorded. Subsequently, after resting in a room with regular light, the control group garnered a systolic blood pressure of 120 mmHg, which falls under the normal range. In determining the mean, the researchers utilized t test wherein the obtained systolic blood pressure of the participants was summated then divided to the sample size.

**Table 4. Mean Systolic Pressure of the Experimental Group**

	Mean	SD	Interpretation
Pretest	125	5.97	High
Posttest	116	6.23	Normal

Table 4 shows the mean scores of the experimental group before and after the intervention. After doing the same exercise that the control group did, the experimental group's blood pressure was measured, which yielded the same results as the control group. After measuring the participants blood pressure, a mean score of 125 mmHg was obtained. On the other hand, after being exposed to blue light, the experimental group garnered a mean score of 116 mmHg.

**Table 5. Difference Between the Pretest and Posttest Results of the Experimental Group**

	Mean	P Value*	Decision
Pretest	125	0.00	Do not reject H <sub>A</sub>
Posttest	116		

\*Significant at 0.05 level

Table 5 shows the result obtained in the experimental group by using t-statistics. As observed from the table, the pretest scores of the experimental group resulted in a mean of 125, while the post-test scores showed a mean of 116. Before the pretest, the participant's blood pressure was measured in order to establish baseline data. While this data is not relevant to the study, it allowed the researchers to know if the participant's blood pressure increased after performing a cardiovascular exercise. During the pretest, the researchers subjected their participants to a 10-minute pedal workout with 30 pedals per minute. Afterwards, the participant's blood pressure was measured. As expected by the researchers, the participants' blood pressure increased, ranging from 130 to 140 mmHg, resulting in an average of 125 mmHg. Immediately after doing the exercise, the participants entered an air-conditioned room illuminated with a blue LED light with a wavelength of 415 nanometers. Inside the room, the participants lay down on a bed with their eyes covered while they were exposed to the blue light at a distance of 50 cm from their skin. After 30 minutes of exposure, the participant's blood pressure was immediately measured. The measured blood pressure of the participants resulted in a mean of 116 mmHg. The t-statistics revealed that there was a difference between the pretest and post-test scores of the experimental groups,  $p = 0.00$   $0.05$ . Because of that, the decision falls on not rejecting the alternative hypothesis.

**Table 6. Difference Between the Posttest Results of Control and Experimental Group**

	Mean	P Value*	Decision
Pretest	120	0.03	Do not reject H <sub>A</sub>
Posttest	116		

\*Significant at 0.05 level

Table 6 shows the difference between the posttest results of the control and experimental groups after the intervention. As presented in the table, the posttest mean score of the control group is 120 mmHg. On the other hand, the posttest mean score of the experimental group is 116 mmHg. From these findings, it can be inferred that there is a 4 mmHg difference between the results of the two groups. As mentioned above, the controlled group did not receive the intervention. Although the blood pressure of the control group decreased after being exposed to regular light, it only returned to its normal level of 120 mmHg. This finding could indicate that resting under regular light will only return blood pressure to normal levels and not decrease it. As for the experimental group, its 4 mmHg difference from the control group's posttest score is an indication that blue light can lower blood pressure levels. As indicated in the table, the t-statistics indicate a significant disparity between the posttest scores of the experimental groups, wherein  $p = 0.03 < 0.05$ . Because of that, the decision falls on not rejecting the alternative hypothesis.

## DISCUSSION

The primary objective of this study was to evaluate the effects of blue light therapy on systolic blood pressure (SBP) of the experimental and control group after performing cardiovascular exercise to mimic an increased SBP. The findings indicate a significant decrease in SBP in the experimental group exposed to blue light compared to the control group, which was subjected to regular light. These results suggest that blue light therapy may be an effective, low-cost intervention for managing hypertension.

### *Interpretation of Findings*

As anticipated, the cardiovascular exercise led to an increase in SBP among participants, consistent with the body's

physiological response to physical exertion. Interestingly, not all participants experienced an increase in SBP post-exercise. Factors such as individual differences in metabolism, genetics, nutrition, and lifestyle likely contributed to these variations. Some participants maintained or even lowered their SBP, suggesting a complex interplay of physiological mechanisms that modulate blood pressure response to exercise.

The experimental group's exposure to blue light resulted in a more substantial decrease in SBP compared to the control group. This finding supports the hypothesis that blue light has a beneficial effect on blood pressure regulation. Previous studies have shown that blue light exposure triggers the release of nitric oxide (NO) from the skin into the bloodstream, leading to vasodilation and reduced blood pressure (Hinck, 2018; Stern et al., 2018). This mechanism is consistent with our results, as participants exposed to blue light exhibited a significant reduction in SBP, with a mean posttest score of 116 mmHg. Resting after exercise also played a crucial role in reducing SBP. Moser (2008) and Grassi et al. (2008) found that rest can significantly lower blood pressure, even in hypertensive patients. Our study corroborates these findings, as both groups experienced a decrease in SBP after a 30-minute rest period, with the experimental group showing a more pronounced reduction due to blue light exposure.

Our findings align with those of Stern et al. (2018), who demonstrated that full-body exposure to blue light reduces SBP and improves endothelial function and arterial stiffness. Similarly, Liu et al. (2014) reported that light therapy increases nitrite levels and lowers nitrate levels, contributing to blood pressure reduction. These studies support the efficacy of blue light therapy in managing blood pressure. However, it is important to consider studies that present conflicting results. For instance, some research indicates that the effects of blue light on blood pressure may vary depending on the duration and intensity of exposure, as well as individual differences in skin photoreactivity and baseline cardiovascular health. Further research is needed to fully elucidate these factors and optimize blue light therapy protocols.

### ***Implications for Hypertension Management***

The results of this study suggest that blue light therapy could be a viable, cost-effective alternative for managing hypertension, particularly in low- and middle-income countries where the prevalence of hypertension is rising and access to medications may be limited (Nephrol, 2020; Mills et al., 2016). Blue light therapy requires minimal effort, can be self-administered, and incurs no ongoing costs once the initial equipment is purchased, making it an attractive option for long-term hypertension management. In conclusion, our study demonstrates that blue light therapy significantly reduces SBP following cardiovascular exercise, supporting its potential as an innovative approach to hypertension management. The findings contribute to a growing body of evidence suggesting that non-pharmacological interventions, such as light therapy, can play a crucial role in controlling blood pressure and reducing the global burden of cardiovascular diseases. Future research should focus on optimizing blue light exposure parameters and exploring its long-term effects on blood pressure regulation across diverse populations.

### **Conclusion**

Based on the results obtained after treating the data, the following conclusions were drawn:

- The analysis showed that the average systolic blood pressure of participants in both groups was 125. This finding holds significant importance as it provides valuable information about the blood pressure profiles of the participants. The consistent value of 125 across both groups indicates that before the intervention, there was no noticeable difference in the mean scores of the experimental and control groups with respect to systolic blood pressure.
- Following the intervention, a comparative analysis of the mean systolic blood pressure scores for the control and experimental groups revealed that the control group exhibited a mean score of 120, while the experimental group recorded a mean score of 116. This discernible discrepancy in mean scores strongly suggests that the intervention had a more substantial impact in reducing

systolic blood pressure within the experimental group, as opposed to the control group.

- Based on the findings from comparing the mean scores of the pretest and posttest within the experimental group, a notable disparity is observed between the scores obtained prior to and subsequent to the participants' exposure to blue light. These results imply that the implementation of blue light effectively contributed to the reduction of the participants' systolic blood pressure.
- The result of the mean comparison of the post-test scores of the experimental and controlled group shows that both the experimental and control groups succeeded in decreasing the respondent's systolic blood pressure, however, the experimental group's decrease in systolic blood pressure was more significant compared to the controlled group, making it more successful.

## **Recommendations**

Based on the findings and conclusions presented, the following recommendations are strongly suggested by the researchers to the following:

**Hypertensive Patients.** The researchers would like to recommend this study to hypertensive patients as it presents blue light therapy as a potentially accessible treatment alongside their medications. Considering that blue light therapy offers a cost-effective alternative that can be easily implemented in home settings, hypertensive patients may benefit from incorporating this therapy to improve blood pressure control. It is advisable for hypertensive patients to consult with their healthcare providers and consider blue light therapy as an additional approach to their current medication regimen, as it may provide supplementary benefits in terms of blood pressure management.

**Medical Professionals and Healthcare Providers.** The researchers encourage medical professionals and healthcare providers to consider implementing blue light therapy under proper guidance and supervision. It is essential for healthcare professionals and experts in the field to provide clear instructions on the appropriate duration, intensity, and frequency of blue light exposure to ensure its safe and effective use. Monitoring blood pressure and assessing its response to blue light therapy should be an integral part of the treatment plan, enabling adjustments and

optimization as needed. By combining blue light therapy with traditional medication approaches, individuals with hypertension may have the opportunity to improve their blood pressure control and potentially reduce their reliance on medications alone.

**Future Researchers.** The researchers involved in this study highly recommend that future researchers utilize their findings as a foundation to advance knowledge and conduct further research on evidence-based approaches. To enhance the robustness of the findings, it is suggested that subsequent studies employ a larger sample size to provide more accurate and generalizable results. Additionally, considering the influence of body mass index (BMI) on blood pressure regulation, it is recommended to conduct the study with a specific group of participants characterized by a certain BMI range. Using additional lights is also suggested as it may help to further intensify the decrease of blood pressure. Furthermore, focusing on individuals with hypertension as the target population for future investigations would offer valuable insights into the specific efficacy of blue light therapy in managing hypertension.

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*The Effectiveness of Blue Light Vis-À-Vis Regular Light Therapy in Decreasing  
Systolic Blood Pressure Among Healthy Adult Females in Dasmariñas City,  
Cavite*

%20in%205%20adults,33%25%20between%202010%20  
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## **The Effects of Occupational Pollutants in Peak Expiratory Flow Rate of Tricycle Drivers in Salawag, Dasmariñas, Cavite.**

*(A quasi-experimental study focused on determining the possible effects of chronic pollutant exposure among tricycle drivers via peak expiratory flow rate measurement which can identify occupational-induced health effects.)*

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### **KEYWORDS:**

- **Particulate Matter**
- **Traffic-Related pollutants**
- **Peak Flow Variability**
- **Occupational Lung Health**
- **Tricycle Operators and Drivers Association**

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**Abstract.** Traffic-related pollution produces particulate matter and biological pollutants that significantly induce allergic reactions among highly exposed individuals like drivers, commuters, and road workers. The study aimed to determine the influence of long-term pollutant exposure on the lung function of tricycle drivers via peak expiratory flow rate measurement. The researchers used initial survey questionnaires and interviews to select qualified participants according to the exclusion and

inclusion criteria. Subjects with a prior history of smoking, other

non-driving jobs, hobbies that will likely induce occupational or environmental risk factors, and other diagnosed lung comorbidities were excluded from this study. There were eight recruited research participants. The participants were non-randomly placed into either the control or experimental group. A health education seminar conducted by a licensed respiratory therapist tackled the topics of traffic-related occupational pollutants, occupational lung health, and minimization of pollutants' impact. The participants were also instructed about the purpose and use of peak expiratory flow rate meters. Upon performing five trials of peak expiratory flow rate maneuvers, the three highest trials were recorded. The numerical values were computed, statistically analyzed, and tabulated. Despite the slight decreased peak expiratory flow rate in the study group compared to the control group, upon statistical analysis, occupational pollutants were found to have no significant effect on the actual peak expiratory flow rate of tricycle drivers in Salawag, Dasmariñas, Cavite. The researchers recommend the utilization of other research designs, recruitment of a better sample representation, and health education programs provision to improve the research outcomes.

# **The Effects of Occupational Pollutants In Peak Expiratory Flow Rate Of Tricycle Drivers In Salawag, Dasmariñas, Cavite**

## **INTRODUCTION**

Air pollution is the primary environmental factor contributing to disease acquisition and premature death. It primarily accounts for an estimated seven million premature deaths annually. Air pollution is prevalent in highly urbanized areas with active industries and transportation. Traffic-related pollution produces particulate matter and biological pollutants that significantly induce allergic reactions among highly exposed individuals.

The Philippines ranks 69th out of 131 countries in the 2022 Swiss Air Quality Technology Company IQAir World Quality Report. The country's air quality garners an average concentration of PM<sub>2.5</sub>, three times higher than the annual average recommended by the World Health Organization (WHO). One major cause of the worsening air pollution quality is the prevalent use and increasing number of vehicles in the country (Indolor et al., 2021). Madueño et al. (2019) investigated the black carbon production of PUJs in Metro Manila and found an alarming level of this substance. Nonetheless, prolonged exposure to pollutants may constitute a significant health hazard.

Pulmonary Function Tests (PFTs) are used to quantify respiratory hazards. These non-invasive tests serve as a screening test for the early detection of respiratory abnormalities in individuals with or without present symptoms. It is also crucial for surveilling the chronic health effects of workers exposed to chemical hazards and occupational pollutants. Several pulmonary function tests are available in hospitals and some medical diagnostic clinics.

Among these pulmonary function tests is the peak expiratory flow rate (PEFR) measurement. It calculates the forceful exhaled volume of air from the lungs, thus determining



the effectiveness of exhalation of an individual. PEFs may evaluate any narrowing or obstruction in the airways. Epidemiological studies of occupational diseases, primarily asthma, have been determined using PEF monitoring (Ji et al., 2021). Hence, the researchers decided to pursue a study to determine the effects of occupational pollutant exposure on the peak expiratory flow rate results of tricycle drivers in Salawag, Dasmariñas, Cavite.

The study aimed to determine the effects of occupational pollutants on the peak expiratory flow rate of tricycle drivers in Salawag, Dasmariñas, Cavite. Specifically, the following statement were to be answered--- the mean peak expiratory flow rate variability, effect of occupational pollutant exposure on the mean peak expiratory flow rate results and its significance on the peak expiratory flow rate of tricycle drivers in Salawag, Dasmariñas, Cavite. The following hypothesis "Occupational pollutant exposure had no significant effect on the peak expiratory flow rate of tricycle drivers in Salawag, Dasmariñas, Cavite," is to be tested.

According to the theory proposed by Oftedal et al. (2008), long-term exposure to air pollution is associated with lung function decline in evidence of pulmonary tests. Hourly concentrations of nitrogen dioxide (NO<sub>2</sub>) and particulate matter (PM) less than ten and 2.5 micrometers in traffic-related pollutants were associated with reduced peak expiratory and forced expiratory flow at 25% and 50% of forced vital capacity. Early exposure among children results in aggravated results. This theory might be linked to this paper, as it induced a conclusive claim of deteriorated lung capacity primarily involving the expiratory function with a longer duration of exposure.

The starting data collection of this study will be the participants' profiles. The tricycle drivers will be selected via inclusion and exclusion criteria based on their demographic, occupational, social, medical, and environmental history. The data collection will be done via interviews corresponding to a questionnaire.

Once selected, the participants were asked to join the study through consent forms. A licensed respiratory therapist was hired as an occupational lung health seminar speaker and a rater

to conduct standardized measurement procedure for using the peak expiratory flow rate meter.

## **METHODOLOGY**

### **Research Design**

This study aimed to have a conclusive analysis of results to determine the trends from the gathered data, revealing the effects of occupational pollutants in peak expiratory flow rate results. Therefore, the study will utilize an experimental research design. This design elaborated on how the data is collected and the proper method of analyzing the results, which is most accurate for this study.

A quasi-experimental research design is primarily used to evaluate the effect of manipulated independent variables on one or more dependent variables. It systematically analyzes the stated hypotheses to draw a valid conclusion. It requires a thorough consideration of the variables, the creation of logical hypotheses, and the planning of effective methods to measure the dependent variables. It allows non-random group assignments which enabled the independent variable to be studied in its naturally occurring condition. Any extraneous variables that can be manipulated or eliminate must be controlled to ensure the validity of the data and avert biases. (Bevans, 2019)

### **Research Locale**

The study was conducted at the SSDGC (Salawag Salitran Diamond Golden City) TODA Tricycle Station in Salawag, Dasmariñas, Cavite. The City of Dasmariñas consists of barangays that cater to tricycle driving as one of the primary modes of transportation. Among all 75 barangays in Dasmariñas Cavite, Brgy. Salawag was the most populated and urbanized area, with 78,778 residents. It connotes a significant demand for public transportation and the barangay's active transportation industry. Brgy. Salawag caters to vehicles, from private cars to tricycles, which produce pollutants from the vehicle's exhaust.

### **Research Participants**

The City of Dasmariñas, Cavite, had the largest population, 703,141 individuals. Among its barangays, Brgy. Salawag had the most number of residents. It catered to a significant demand in public utility transportation. Transportation includes, but is not limited to, jeepneys, UV express, and tricycles.

The researchers recruited a population of tricycle drivers residing in Brgy. Salawag, Dasmariñas, Cavite. The participants must be a part of the SSDGC (Salawag Salitran Diamond Golden City) TODA Tricycle station.

Participants who were smokers and had other occupations or hobbies and social endeavors likely to induce occupational-induced risk factors are excluded from this study. Participants with diagnosed lung diseases and comorbidity were excluded from the recruitment.

The participants were divided into the control and experimental groups. The control group are the tricycle drivers with shorter tricycle driving experience (4-6 years), while the experimental group are the drivers longer in service (7-11 years). The group assignment was determined by calculating the median length of the participants' service duration. The upper median limit was the control group, while the participants in the lower median limit were the experimental group.

### **Sampling Technique**

The study utilized simple random sampling. This probability sampling selected a sample subset that best represents the population while averting biases. It provided the most significant possible subset by utilizing Slovin's formula to calculate the representative sample size, thus providing a precise estimated population proportion. This sampling method is generally considered among studies with large population sizes. The SSDGC (Salawag-Salitran Diamond-Golden City) TODA Tricycle Station consists of 627 drivers designated in varied terminals located in Brgy. Salawag and Brgy. Salitran, Dasmariñas, Cavite. According to Cochran's formula, with a confidence level of 95%, a margin of error of 5%, and a population size of 627 individuals, the representative sample must consist of at least 244 tricycle drivers. The sampling technique mentioned above will ensure a sample that represents the entirety of the target population refined by the set inclusion and exclusion

criteria. The Slovin's Formula is:

$$n = N / (1 + Ne^2)$$

- $n$  = number of samples
- $N$  = Total population
- $e$  = Margin of Error

Upon gathering the answered survey questionnaires, the participants who qualified with the set inclusion and exclusion criteria will be recruited to the study.

### **Data Gathering Procedure Confirmation of the Sample Size**

The researchers contacted the SSDGC (Salawag Salitran Diamond Golden City) TODA Tricycle Station and confirmed the number of its registered tricycle drivers. The researchers used simple random sampling to determine the sample size of the subjects. There are a total of 627 registered tricycle drivers. In the utilization of Slovin's formula and the sampling mentioned above technique, the researchers needed a total of 244 prospective participants for the initial survey.

### **ERB and SSDGC TODA Approval of Research Implementation**

The researchers submitted a letter of intent to the Ethics Research Board committee prior to proceeding to data collection. Upon approval, a communication letter was sent to the president of SSDGC (Salawag Salitran Diamond Golden City) TODA Tricycle Station president to conduct the research officially.

### **Initial Survey Questionnaire Pilot Testing**

The researchers had pretests among selected TODA association board members to assess the efficiency of the questionnaires. The researchers then placed a submission box and survey questionnaires among stations of SSDGC TODA. However, upon realizing that some questions are left unanswered in the questionnaires being placed on the submission box, the researchers decided to have a different approach. The questionnaires with incomplete answers were disqualified. To ensure the adequacy of the response rate among the chosen participants, the researchers actively interviewed numerous tricycle drivers. At the same time, the veracity of the results was ensured as the answers were given verbally and spontaneously.

### **Initial Survey Dissemination**

A submission box was stationed in the TODA tricycle station situated at Brgy. Salawag Dasmariñas, Cavite. There are a total of 305 respondents in the initial survey. The respondents were evaluated based on their answers to the initial questionnaire. The demographic profile includes the name (optional), age, gender, and years of duration of tricycle driving. The medical history consisted of questions about the diagnosed comorbidities and present illnesses of participants and whether they take maintenance drugs. The participants' smoking histories were gathered. The data on whether they smoked or not or had been exposed to second-hand smoke were analyzed. The tricycle drivers are also asked about their social activities and hobbies. Several hobbies that are predisposed to a substance or chemical exposure were evaluated. The survey questionnaire included questions regarding ownership of pets as it might play a factor in allergen exposure. The occupational profile was also evaluated by asking the respondents about their past and present occupations other than tricycle driving that may likely cause susceptibility to other pollutants.

### **Recruitment of Participants Qualified in Inclusion and Exclusion Criteria**

The participants' questionnaires were evaluated using the inclusion and exclusion criteria of the study. The inclusion criteria of the study involved tricycle drivers residing in Brgy. Salawag, Dasmariñas, Cavite who were members of the SSDGC (Salawag Salitran Diamond Golden City) TODA Tricycle station. Participants who were smokers and had other occupations or hobbies and social endeavors likely to induce occupational-induced risk factors are excluded from this study. Participants with diagnosed lung diseases and comorbidity were excluded from the recruitment.

### **Partition of Subjects in Control and Experimental Group**

The participants were divided into the control and experimental groups. The control group are the tricycle drivers with shorter tricycle driving experience (4-6 years), while the experimental group are the drivers longer in service (7-11 years). The group assignment was determined by calculating the median length of the participants' driving service duration. The upper median limit was the control group, while the participants in the lower median limit were the experimental group. Among 305 respondents, only 11 participants were able to meet the criteria.

An informed consent was sent to them and only eight participants agreed to the study.

### **Health Seminar Implementation and PEFR Measurement**

The participants and researchers arranged a date and venue on which the research will be conducted. Before the seminar and procedure, the researchers prepared a mouthpiece for each participant to be attached to the peak expiratory flow meter. Vital signs equipment are presented as a precaution to monitor and ensure the safety of participants.

The researchers and a recruited licensed respiratory therapist conducted a seminar regarding the effects of occupational pollutants and the purpose and use of peak expiratory flow rate meters. Once the participants could confidently use the device, they were asked to perform five fast, forceful, and maximal expiratory flow maneuvers while ensuring an airtight seal between the lips and mouthpiece. The highest value reached by each participant will be recorded. The results will be collected. At the same time, the participants' height will be recorded as it will be used to calculate their predicted PEFR values.

### **Research Instrument**

The instrument used in this study is a survey questionnaire through which the respondents were asked about their demographic profile and social, occupational, and environmental history. Once evaluated, the participants were taught peak expiratory rate maneuvers and asked to demonstrate them afterward. The peak expiratory rate results of the participants were compared to the predicted PEFR measurement. To compute the predicted PEFR measurement, the researchers utilized the MDCalc Estimated/Expected Peak Expiratory Flow Calculator. The app calculated an estimated predicted PEFR result based on an individual's age, race, and height. The following application uses the equation from Hankinson (1999) NHANES III and Knudson (1983). the formula is the following:

$$\text{PEFR (male)} = \{[(\text{Height (m)} \times 5.48) - [\text{Age} \times 0.041]] \times 60$$

$$\text{PEFR (female)} = \{[(\text{Height (m)} \times 5.48) - [\text{Age} \times 0.041]] \times 60$$

A *Peak Expiratory Flow Meter* is a portable or handheld device used to forcefully measure a person's air capacity to exhale

after a deep inhalation. According to DeVrieze et al., 2023, the peak flow meter uses the traditional traffic light color as an indicator for interpreting the scores of the peak flow variability.

**Green Zone:** Usually set at 80% to 100% of personal best or normal peak flow. As long as no symptoms are present, the patient is considered to be in a steady state. No changes are needed to the present regimen.

**Yellow Zone:** Fifty percent to 80% of personal best. Patients are typically instructed to employ their home action plan when identifying repeated readings in this zone. Standard action plans include increasing the dose and frequency of short-acting beta-agonists and possibly increasing inhaled corticosteroid doses. Action plans often remind the patient to look for and avoid noxious stimuli such as fumes and second-hand smoke.

**Red Zone:** Fifty percent or less of personal best. Peak flow measurements in this range indicate that severe airway obstruction may be occurring and should be considered a medical emergency.

## **Data Analysis**

### **Mean and Standard Deviations**

This study evaluated the statistical significance of the PEFR results of the control and experimental groups by computing the mean and standard deviations. The mean is used to compute the average number of scores. It determined the centrality of the numerical values garnered from the research. On the other hand, the standard deviation (SD) measures how scattered a set of values is (El Omda et al., 2023). A small standard deviation means that the data are closer to the mean value, while a large standard deviation means that the data collected are more scattered from the mean. Both of these are considered descriptive statistics. These two statistical methods will compare the mean and standard deviations among the values from the control and experimental groups. These values were essential in computation of independent t-test.

### **Independent t-test**

On the other hand, an independent t-test is also used. It measured the extent of a significant difference between the sets of data. The corresponding p-value will determine, answering

whether the null hypothesis was true or not. The t-test and the p-value established a significant relationship or difference between variables (Deauna, 2011). A p-value equal to 0.05 or less was considered statistically significant. The researchers hired a statistician to analyze and validate the PEFR results.

### **Peak Flow Variability**

The peak flow variability was calculated to determine how apart or scattered the predicted values would be from the actual PEFR values of the participants using the formula below. The mean peak flow variability of the control group is compared with the experimental group.

**Peak Flow Variability (%)** = (Actual PEFR/ Estimated PEFR) x 100

### **Data Presentation**

The results are presented in tabular form to compare the statistical significance of the results of both the control and experimental group.

Upon computing the p-value and t-test, the researchers accepted the null hypothesis. The null hypothesis states that occupational pollutant exposure does not significantly affect the peak expiratory flow rate of tricycle drivers in Salawag, Dasmariñas, Cavite.

The hired statistician computed, tabulated, and analyzed the raw numerical values accordingly. The researchers correlate the statistical findings to its interpretation relating to the study.

### **Ethical Consideration**

The researchers wrote a letter of intent for the study. The letter was addressed to the Institutional Ethical Board Committee (IERB), EAC-C School of Respiratory Therapy Faculty and Dean, and the SSDGC TODA President. The study was approved by IERB on February 13, 2024 with ERB Code 2024-01-001. An informed consent form was sent to the participants. The informed consent was sent on March 15, 2024, to the participants who qualified within the set inclusion and exclusion criteria.



There are 11 prospective participants. Among the contacted subjects, only eight were voluntarily recruited in the study. The informed consent was scanned and saved in a Google Drive folder. After a year, the data gathered were set to be discarded to the Google Drive trash bin to no avail of being restored to secure and protect the participants' privacy.

Participants' safety will be the utmost priority during the study. It was ensured by explaining thoroughly to the participants before the procedure the possible hazards and risks of peak expiratory flow rate (PEFR) measurement. Vital signs taking and monitoring are ensured before and after the procedure. A 3-5 second rest that accompanied each expiratory maneuver ensured the subject's comfort. The usage of disposable mouthpieces per participant prevented cross-contamination. The researchers also applied thorough disinfection and sterile techniques during the procedure. Cutasept F, a colorless propanol-based skin antiseptic, was used between subjects. It is mainly used in hospital surgical procedures and is known for its broad-spectrum bactericidal, tuberculocidal, fungicidal, and virucidal capabilities.

Data confidentiality was assured during data gathering by solely keeping the participants' contact information at the researchers' discretion. According to Republic Act 10173 or Data Privacy Act of 2012, the data gathered during research proceedings must be as minimal as possible and subjected purely to achieve the research objectives. The data gathered shall be held under strict confidentiality and should not be intended for any personal interest or attributable to public disclosure.

The data gathered during the study was needed information necessary for the study and consented by the participants. The papers containing data were appropriately stored in a separate box aside from the box used as a holder for the survey questionnaires. Another paper case was used for informed consent. The papers containing participants' data were handled and kept by the researchers and would be shredded after a year of data safekeeping.

RESULTS

Demographic, Occupational, Social, Environmental, and Medical profile

Table 1  
The Control Group’s Demographic, Occupational, Social, Environmental, and Medical profile

Subject (Control Group)	Gender	Age	Years of driving	Height (inches)	Smoking history			Social History	Occupational History	Environmental History	Medical history
					Smoker	Nonsmoker	Secondhand Smoke Exposure				
1	Male	29	5	66	x	✓	x	-No recorded hobbies (that might be associated to exposure to substances)	-No other occupation other than tricycle driving that were predisposed to exposure to chemicals or substances	-No pets at home -Home not located near the roadsides nor establishments producing chemicals or substances	-No diagnosed comorbidities nor disease -No maintenance medications -No recurring symptoms such as shortness of breath, allergies, and the like
2	Male	52	6	70	x	✓	x				
3	Male	31	5	64	x	✓	x				
4	Male	25	4	65	x	✓	x				

Table 2  
The Experimental Group’s Demographic, Occupational, Social, Environmental, and Medical profile

Subject (Experimental Group)	Gender	Age	Years of driving	Height (inches)	Smoking history			Social History	Occupational History	Environmental History	Medical history
					Smoker	Non smoker	Second hand Smoke Exposure				
1	Male	56	9	64	x	✓	x	-No recorded hobbies (that might be associated to exposure to substances)	-No other occupation other than tricycle driving that were predisposed to exposure to chemicals or substances	-No pets at home -Home not located near the roadsides nor establishments producing chemicals or substances	-No diagnosed comorbidities nor disease -No maintenance medications -No recurring symptoms such as shortness of breath, allergies, and the like
2	Male	42	17	66	x	✓	x				
3	Male	36	11	64	x	✓	x				
4	Male	50	7	65	x	✓	x				

The control subjects had a shorter duration of driving with a mean of 5 years than the experimental group. The experimental group's mean driving duration is 11 years. The age and height of the subjects are both used to determine the subjects' predicted peak expiratory flow rate (PEFR).

All of the subjects in both groups are nonsmokers and not subjected to second-hand smoking exposure in both the workplace and at home. The subjects did not have past or present occupations other than tricycle driving that predisposed them to any substances or chemical exposure. As mentioned earlier, the exclusion evaluation criteria relating to hobbies-inducing substance exposure had been based on Themes's (2016) list of hobby pursuits predisposed to such respiratory insults. They also had no associated comorbidities or diseases or were taking any maintenance medications. The subjects had no prior exposure to other substances other than what they were exposed to while driving.

### **Actual PEFR and Estimated PEFR**

Table 3

*The Control Group's Actual PEFR and Estimated PEFR*

<b>Subject</b>	<b>Actual PEFR</b>	<b>Predicted PEFR</b>
1	577	575
2	570	551
3	497	480
4	717	576

**Table 4**

*The Experimental Group's Actual PEFR and Estimated PEFR*

<b>Subject</b>	<b>Actual PEFR</b>	<b>Predicted PEFR</b>
1	447	508
2	460	526
3	527	557
4	497	515

The actual PEFR based on the measured PEFR of the subjects in both the experimental and control group had been tabulated above. The estimated PEFR and PEFR Variability of the participants which was determined using MDCalc PEFR Calculator are indicated (refer to Appendix B). The peak expiratory flow rate variability is computed by associating the actual PEFR and the predicted PEFR.

**Peak Expiratory Flow Rate Variability**

Table 5

*The Peak Flow Variability of the Subjects*

Peak Expiratory Flow Rate Variability					Mean
Control	Subject	Subject	Subject 3	Subject	100%
	1	2		4	
	100%	100%	100%	100%	
Experimental	Subject	Subject	Subject 3	Subject	91.5%
	1	2		4	
	87%	87%	87%	87%	

Table 5 presents the summary of the data gathered from the subjects of both control and experimental group on their peak expiratory flow rate variabilities. The control group has four (4) participants. The mean PEFR variability of the control group is 100%. On the other hand, the mean PEFR variability of the experimental group is 91.5%. The mean PEFR variability of the control group is higher than the mean PEFR variability of the experimental group with 8.5% difference.

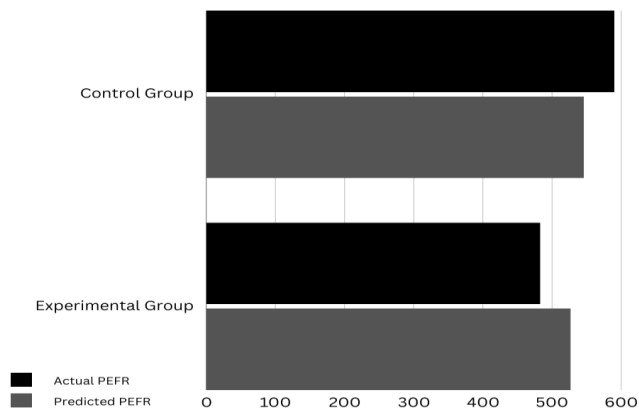


Figure 1. Bar Graph of Control Group and Experimental Group's Actual and Predicted Peak Expiratory Flow Rate (PEFR)

In Figure 1, the experimental group displayed a lower actual PEFR value than both its predicted PEFR and the actual PEFR of the control group.

Data of the Control Group

Table 6

Data of Control Group

SAMPLE SIZE	Predicted PEFR		Actual PEFR	
	Mean PEFR	Standard Deviation	Mean PEFR	Standard Deviation
4	545.50	45.17	590.25	91.92

Table 6 presents the summary of the data gathered

from the participants of the control group on their predicted peak expiratory flow rates as well as on their actual peak expiratory flow rates.

The estimated peak expiratory flow rate results was computed in consideration of factors such as age, gender, height, body surface area, and race (Ramamani & Kanna, 2020) (refer to Appendix B). On the other hand the actual PEFr of the subjects are gathered from the peak expiratory flow rate measurement conducted by the researchers and recruited respiratory therapist.

The control group has four (4) participants. The mean predicted peak expiratory flow rate (PEFR) of the control group is 545.50 with a standard deviation of 45.17. On the other hand, the mean actual peak expiratory flow rate (PEFR) of the control group is 590.25 with a standard deviation of 91.92.

The mean actual peak expiratory flow rate (PEFR) of the control group of 590.25 is higher than the mean predicted peak expiratory flow rate (PEFR) of the control group of 545.50.

**Data of the Experimental Group**

Table 7

*Data of Experimental Group*

Sample Size	Predicted PEFR		Actual PEFR	
	Mean PEFR	Standard Deviation	Mean PEFR	Standard Deviation
4	526.50	21.64	482.75	36.32

Table 7 summarizes and presents the data gathered from the participants of the experimental group on their predicted peak expiratory flow rates as well as on their actual peak expiratory flow rates.

The experimental group has four (4) participants. The mean predicted peak expiratory flow rate (PEFR) of the experimental group is 526.50 with a standard deviation of 21.64. On the other hand, the mean actual peak expiratory flow rate (PEFR) of the experimental group is 482.75 with a standard deviation of 36.32.

The mean actual peak expiratory flow rate (PEFR) of the experimental group of 482.75 is lower than the mean predicted peak expiratory flow rate (PEFR) of the experimental group of 526.50.

The predicted peak expiratory flow rate (PEFR) of the experimental group is compared with its actual peak expiratory flow rate (PEFR) using paired t-tests at 5% level of significance, and the results are summarized and presented in Table 7.



## **Comparison of the Mean Predicted Expiratory Rates of Control and Experimental Groups**

Table 8

*Comparison of the Mean Predicted Expiratory Rates of Control and Experimental Groups*

Group	Sample	Mean Predicted PEFR	t-value	p-value	Decision	Conclusion
Control	4	545.50	0.76	0.48	Accept $H_0$	Not Significant
Experimental	4	526.50				

The t-value of 0.76 has a corresponding p-value of 0.48 which is more than the level of significance of 0.05. Thus the null hypothesis is accepted. It is, therefore, concluded that there is no significant difference between the mean predicted peak expiratory flow rate (PEFR) of the control group and the mean predicted peak expiratory flow rate (PEFR) of the experimental group.

Table 8 summarizes and presents the results of independent t-test, at 5% level of significance, used to determine whether there is significant difference between the mean predicted peak expiratory flow rate (PEFR) of the control group and the mean predicted peak expiratory flow rate (PEFR) of the experimental group.

This is solely used to determine whether the predicted PEFR of both groups had no significant difference to one another. As variation from their predicted might cause bias attrition when the actual PEFR of both groups are then compared together.

## Comparison of the Predicted PEFR and Actual PEFR of the Control Group

Table 9

*Comparison of the Predicted PEFR and Actual PEFR of the Control Group*

Group	Mean PEFR	Sample	t-value	p-value	Decision	Conclusion
Control	Predicted 545.50	4	-1.39	0.26	Accept $H_0$	Not Significant
	Actual 590.25					

The predicted peak expiratory flow rate (PEFR) of the control group is compared with its actual peak expiratory flow rate (PEFR) using paired t-tests at a 5% level of significance, and the results are summarized and presented in Table 9.

The t-value of -1.39 has a corresponding p-value of 0.26 which is greater than the level of significance of 0.05. This warrants the acceptance of null hypothesis. It is, thus, concluded that there is no significant difference between the mean predicted peak expiratory flow rate (PEFR) and the mean actual peak expiratory flow rate (PEFR) of the control group.

## Comparison of the Predicted PEFR and Actual PEFR of the Experimental Group

Table 10 *Comparison of the Predicted PEFR and Actual PEFR of the Experimental Group*

Group		Mean PEFR	Sample	t-value	p-value	Decision	Conclusion
Experimental	Predicted	526.50	4	3.74	0.03	Reject H <sub>0</sub>	Significant
	Actual	482.75					

The t-value of 3.74 has a corresponding p-value of 0.03 which is less than the level of significance of 0.05. This warrants the rejection of null hypothesis. It is, thus, concluded that there is significant difference between the mean predicted peak expiratory flow rate (PEFR) and the mean actual peak expiratory flow rate (PEFR) of the experimental group.

The mean predicted peak expiratory flow rate (PEFR) of the control group and the mean predicted peak expiratory flow rate (PEFR) of the experimental group are compared using independent t-test at 5% level of significance, and the results are summarized and presented in Table 10.

## Mean Actual and Predicted PEFR of Control and Experimental Groups

Table 11

*Comparison of the Mean Actual Expiratory Rates of Control and Experimental Groups*

Group	Sample	Mean Actual PEFR	t- value	p- value	Decision	Conclusion
Control	4	590.25	2.18	0.07	Accept Ho	Not Significant
Experi- mental	4	482.75				

The t-value of 2.18 has a corresponding p-value of 0.07 which is greater than the level of significance of 0.05. Thus the null hypothesis is accepted. It is, therefore, concluded that although there is a lower PEFR among subjects of the experimental group, statistically, there is no significant difference between the mean actual peak expiratory flow rate (PEFR) of the two groups.

## DISCUSSION

The peak expiratory flow rate (PEFR) is an effort-dependent pulmonary function parameter which commences from the large airways within the start of the forced expiration. It is beneficial in evaluating the extent and the rate of progression of the disease process. It also serves as a surveilling parameter of an individual's lung function. The

present study was undertaken to establish the effect of occupational pollutants on the respiratory function of tricycle drivers by measuring their PEFR.

The subjects are grouped into either control or study groups. The assignment of subjects into groups was based on the length of their driving duration. This categorization aimed to present how the occupational pollutants affect the peak expiratory flow rate (PEFR) of the participants. This is based on the findings from the systematic analysis study conducted by Boogard et al (2022) that longer exposure to road traffic pollutants induces adverse health outcomes. Hence, the designation might reveal the effects of occupational pollutants on subjects that are more susceptible to exposure than those with less susceptibility.

The participants' age and height are used to compute the predicted peak expiratory flow rate. The predicted PEFR serves as a baseline of the estimated normal PEFR value of an individual.

The inclusion and exclusion refined the participants resulting in subjects that are non-smokers and not subjected to second hand smoking exposure in both the workplace and at home. The subjects did not have past or present occupations other than tricycle driving that predisposed them from any substances or chemical exposure. They also had no associated comorbidities and diseases nor were they taking any maintenance medications. The subjects had no prior exposure to other substances other than what they are exposed into while driving.

The predicted PEFR rate gives an estimate of the value an individual might have to determine the status of their air caliber. Upon measurement of the actual PEFR of the subjects, both groups exhibit a normal calculated PEFR variability within 80- 100%. However, the experimental group displayed a slightly higher mean PEFR variability difference of 8.5% (100% - 91.5%) as compared to the control group (Refer to *Table 3*). Nonetheless, both of the groups PEFR variability are within the normal range. On the other hand, as the control group was characterized by lower tricycle driving duration and thus, might have been less likely exposed to occupational

pollutants than the experimental group, the higher PEFR variability connoted a possible downward trend on the PEFR values of subjects with longer exposure to occupational pollutants. This might be due to the presence of the anthropometric factors associated in the study, the pollutant exposure, or other extrinsic factors that may not be discussed in this paper.

This finding might be linked to the study conducted by Singh, Meena, & Sharma (2012) as they indicate that there is a larger peak flow variability between mean values of patients with various lung conditions such as asthma and bronchiectasis compared with normal healthy subjects. It is important to note that PEFR is not the sole basis to induce a proper diagnosis. Nevertheless, the slight difference in PEFR variability indicates that the experimental group's actual PEFR results differ from what was predicted based on various factors (age, height, and race), possibly due to other certain aspects that might be attributable to the subjects' longer exposure to occupational pollutants.

The experimental group has lower mean PEFR as compared to the control group. This finding suggests that exposure to occupational pollutants might have decreased mean PEFR values respective to the duration of exposure to these irritants. However statistically, it has been concluded that there is no significant difference between the mean predicted peak expiratory flow rate (PEFR) of the control group and the mean predicted peak expiratory flow rate (PEFR) of the experimental group. In a study conducted by Mukhtar & Abdullahi (2022), meat roasters had statistically significantly lower PEFR than the control group. They concluded that there is a positive correlation with the subjects' PEFR and their duration of being exposed to occupational pollutants.

The experimental group displays a lower mean actual PEFR than its predicted PEFR. On the other hand, the control group shows a higher mean actual PEFR than its predicted PEFR. This finding entails that there is no significant difference between the actual and predicted PEFR of the subjects in the control group while there is otherwise an effect on the experimental group. This corresponds with the tallied

peak expiratory flow rate variability above, hence indicating that those with lower exposure to occupational pollutants display lower effects on airway patency and pulmonary function as compared with those with higher exposure duration.

A study conducted by Bansal et al in 2022, indicates that there is a significant decrease among actual PEFR values on subjects with more exposure to occupational and smoke irritants than their predicted PEFR. On the other hand, they also display a significant effect on their PEFR than those subjects with lower exposure to smoke and occupational pollutants.

Upon assessment between the control group and experimental group's subjects' mean PEFR, a t-value of 2.18 is calculated with a corresponding p-value of 0.07, Hence, the null hypothesis is accepted. This entails that there is no significant difference between the mean actual peak expiratory flow rate (PEFR) of the control group and the mean actual peak expiratory flow rate (PEFR) of the experimental group.

## **Conclusion**

Upon evaluation of the gathered data, the researchers concluded the following. Firstly, the mean peak expiratory flow rate variability difference of the experimental group is found to be higher than that of the control group. This corresponded with the experimental group exhibiting a statistically significant difference between actual peak expiratory flow rate as compared to its predicted values. On the other hand, the mean actual PEFR of the experimental group found to be lower than the control group. This finding might be attributable to the effect of occupational pollutant exposure upon subjects with longer duration of tricycle driving. All of the statistical findings connote a downward trend in the PEFR of the experimental group, who are more likely to be induced by more prolonged occupational pollutant exposure than the control group. However, with the use of independent t-test, the occupational pollutants are found to have no statistical significant effect on the peak expiratory flow rate of tricycle drivers in Salawag, Dasmariñas, Cavite.

## **Recommendations**

The following recommendations are stated to provide suggestions based on the study's findings. These might guide further investigations, broaden the research scope, and formulate future policies and interventions in respiratory therapy.

The research is conducted via a quasi-experimental nature in a real life condition and basis. By controlling the degree of exposure in an artificial environment created mostly in true experimental research settings, the most accurate data will be guaranteed. A pretest-posttest research design is effective in establishing a more accurate effect whilst averting biases and controlling the extraneous variables present among subjects. To further evaluate the effects of occupational pollutants among road workers, a cohort study might be efficient in determining the health outcome the pollutants may induce over a period of time. It might establish an exploratory approach while providing an intricate series of routine evaluations.

A larger population might provide better sample representation amplifying the objectives of the study and to induce a statistical significance. Eliminating further extraneous variables in both the control and study group might ensure lower standard deviations, thus, increasing the accuracy of the data to be gathered. Extraneous factors such as length of exposure on a daily basis, nutrition, and physical activity and other related aspects must be taken into account.

To provide better outcomes in addressing the issue of occupational pollutants, an in-depth, comprehensive, and routine conduction of health education programs might be induced.



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# THE EFFECTS OF PRESCRIPTION GLASSES ON THE NEAR VISION TASKS OF RESIDENTS IN SITIO BISAYA: BASIS FOR A PROPOSED VISION CARE PROGRAM

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## **KEYWORDS:**

- **Reading**
- **Non – Reading**
- **Work**
- **Hobbies**
- **Presbyopia**
- **40 years old**

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**Abstract.** The sense of seeing is essential for people of all ages to carry on their daily activities of life. If vision is compromised, it becomes more difficult on achieving such tasks. Most people that are aged 40 and above are prone to experience such difficulties, and to further help them, prescription reading glasses are given to be able to perform tasks well at near.

Through the help of prescription reading glasses, the difficulties will be addressed which in turn will provide an effect in terms of achieving tasks of reading and non – reading on work and hobbies. The participants were selected with through quota sampling and voluntary sampling, where the participants have undergone different procedures and examination to determine certain aspects of their vision. A pre and post questionnaire was given to assess and identify what would be the changes prior to the prescription of

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PROGRAM*

their glasses. Results show that there is a substantial positive effect after the participants were given their prescription reading glasses resulting into increased relief and increased productivity. The results of the study will provide the basis on what could be the programs that can be applied in the future within the same community.

# **THE EFFECTS OF PRESCRIPTION GLASSES ON THE NEAR VISION TASKS OF RESIDENTS IN SITIO BISAYA: BASIS FOR A PROPOSED VISION CARE PROGRAM**

## **INTRODUCTION**

One of the most significant aspects of one's quality of life, particularly for those over 40, is near vision, which is a crucial component of the visual system that enables close observation of objects. Presbyopia is an age-related disorder that affects near vision, making it harder for elderly people to focus on and read close-up things. Presbyopia affects several jobs, including written communication, object recognition, cooking, farming, reading, sewing (needle threading), answering the phone, and getting dressed are areas of concern. Additionally, presbyopia also continues to rise in number as the population ages which there is a need for programs that will help the in-need population.

## **METHODOLOGY**

In this study, Quota and Voluntary Sampling Technique was used on Presbyope patients of Sitio Bisaya Residents. Researchers conducted vision care outreach in which the Far and Near Visual Acuity of respondents was measured as well as their Refractive Power at near as basis for reading glass prescription. Pre and Post assisted near vision questionnaire was also used to know the effects of reading prescription to respondent's daily life activity and a five- days journal was given which participants needed to provide a picture and five near tasks that they did with the prescription glass after two weeks to prove the reliability of the respondents in using the new prescription reading glasses while doing their near tasks.

Ethical Consideration

As recommended of the Ethics Review Board dated January 09,2023 is to proceed with the study and was Granted Approval- having been found free from ethical issues and violations set forth by the EACC Ethics Review Committee signed January 22 and 23, 2024 by the Chair of the EACC Ethics Committee and Director of EACC Research and Development Office with ERC Code 2023-01-025.

RESULTS

1. Near vision tasks status of the subjects prior to the giving of the prescription reading glasses.

1.1. Reading tasks

Table 1. Summary of descriptive statistics in the status of near vision of the subjects prior to giving of the prescription reading glass in terms of reading tasks

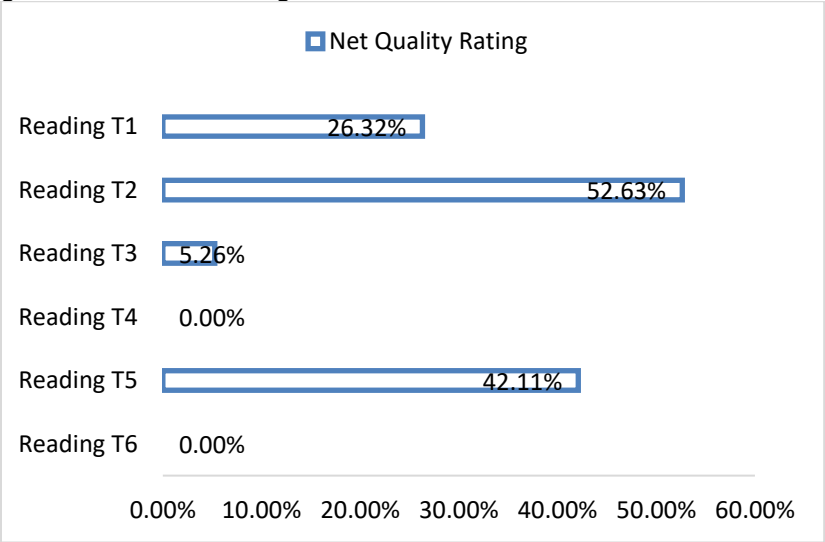


Table 1 shows the status of near vision of the subjects prior to the giving of their prescription reading glass in terms of

reading tasks shows that Question 2 (blurring of vision when reading labels of medicine bottles and food packaging) has the best interpretation, with a quality rating of 52.63%, which is given an interpretation of Always. The interpretation implies that the respondents always have trouble seeing clearly labels or directions on food packages or pharmaceutical bottles. On the other hand, questions 4 (writing on small cards, notes, documents) and 6 (difficulty maintaining focus at prolonged work) placed bottom, with a quality rating of 0%. This means that respondents often experience difficulties writing and reading on small cards, notes, and letters, filling out paperwork and forms, and signing their names and affixing signatures, as well as retaining focus during lengthy periods of near work (three (3) hours or more).

### 1.2. Non-Reading Tasks: Home and Work

Table 2. *Summary of descriptive statistics in the status of near vision of the subjects prior to the giving of the prescription reading glass in terms of home and work task*

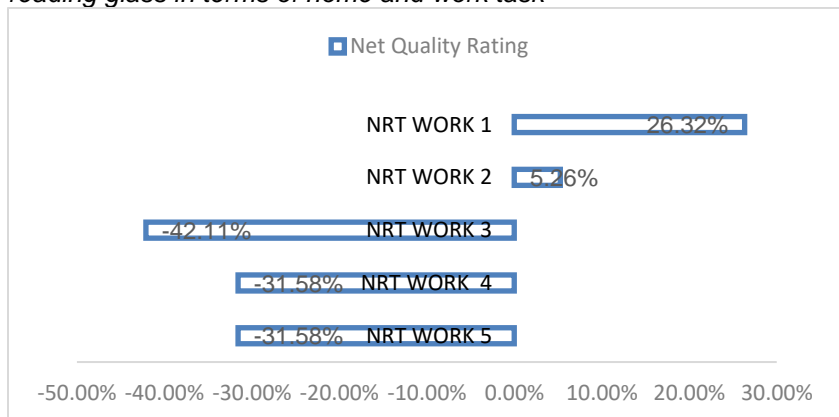


Table 2 shows the status of the near vision tasks of the subjects prior to the giving of the prescription reading glasses in terms of reading tasks. Questions 1 (hard time using mobile phones or tablet) and 2 (squinting when sewing or threading a needle) are among the top with 42.11 % each with an interpretation as Often. Therefore, without prescription glasses, the more tasks the participants have a difficult time reading like messages in their mobile phones or tablets, as well as they need to squint especially when sewing or threading a needle. On the



other hand, the remaining questions of 3 (doing well with handicrafts), 4 (properly repair items needed to be repaired), and 5 (properly prepare, wash and cook) indicate that participants have difficulty Sometimes.

1.3. Non-reading tasks: Hobbies

Table 3. *Summary of descriptive statistics in the status of near vision of the subjects prior to the giving of the prescription reading glass in terms of hobbies*

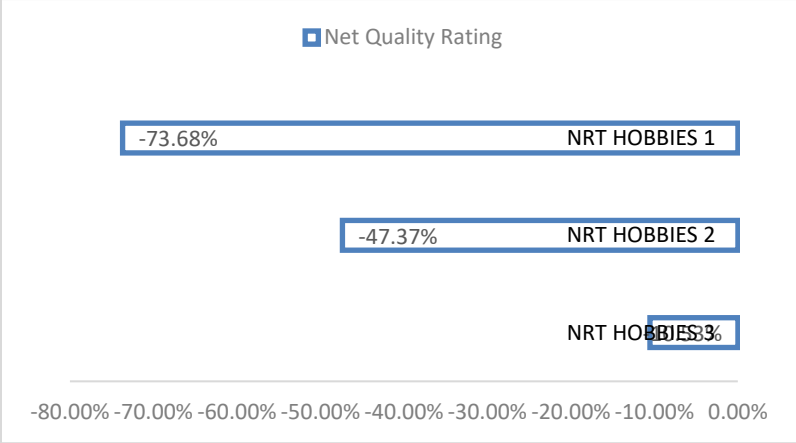


Table 3 indicates the status of near vision of the subjects prior to the giving of the prescription reading glass in terms of hobbies. Question 2 (experiencing blurring or doubling of vision while cross stitching) and 3 (blurring of vision while answering newspaper or mobile games), are rated with -47.37% and -10.53%, respectively, interpreted as Sometimes. This states that the participants sometimes do experience blurring or doubling of vision while cross stitching, as well as blurring when answering newspaper or mobile games. On the other hand, the interpretation for question 1 (able to play cards, chess and dominos) was Never, meaning that the participants may not have been playing the said games after all.

## 2. Near vision tasks status of the subjects after giving the prescription reading glasses.

### 2.1. Reading tasks

Table 4. *Summary of the descriptive statistics on status of the subjects after using the near prescription reading glass in terms of reading task*

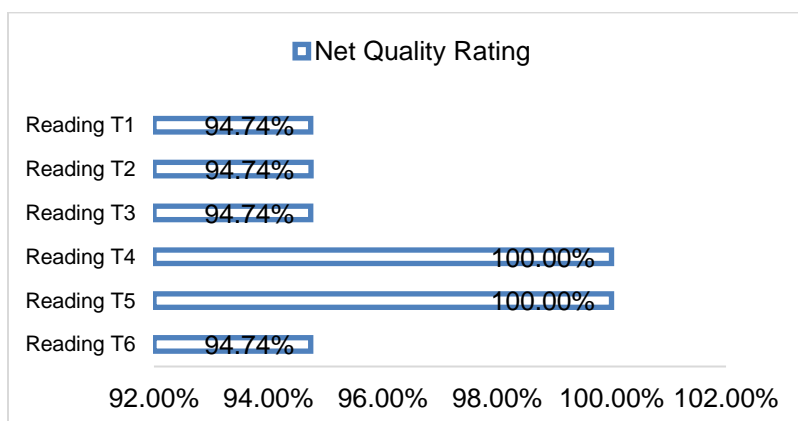


Table 4 shows the status of the near vision tasks of the subjects after using the prescription reading glasses in terms of reading tasks. Based on the response of the participants, Question 4 (difficulty with writing and reading small cards, documents and forms) and 5 (doubling of vision when viewing objects at close distance at low or dim illumination) ranked first with a net quality rating of 100% which gives an interpretation recorded as Never. This means that respondents never suffer difficulty in writing on small cards and reading, notes, and letters as well as doubling of vision while examining items at close range under low or dim lighting. However, Questions 1 (difficulty reading small print including newspaper and magazines), 2 (blurring of vision when reading label on medicine bottle/food packaging), 3 (blurring of vision when reading prints on electricity and water bills, bank statements), and 6 (difficulty maintaining focus at three hours) ranked as the lowest, with a net quality rating of 94.74% and an interpretation of Never.

2.2.Non- reading tasks: Home and Work

Table 5. *Summary of descriptive statistics in the status of near vision of subjects after using the near prescription reading glass in terms of home and work task*

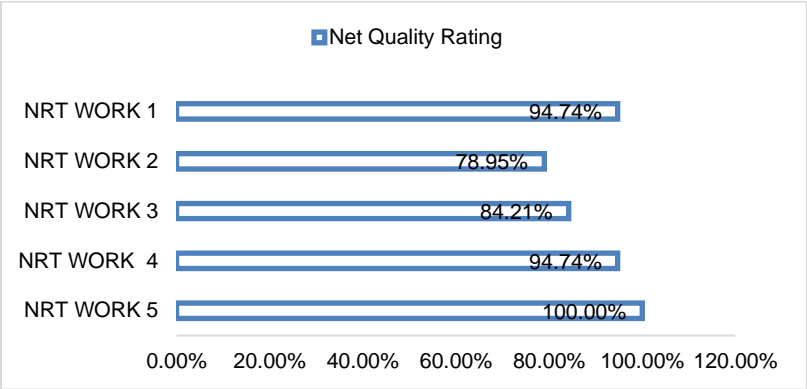


Table 5 shows the status of the near vision tasks of the subjects after using the prescription reading glasses in terms of home and work tasks. Based on the responses, Question 5 (able to properly prepare food, wash and cook) ranked first with a net quality rating of 100% and recorded an interpretation of Never. This means that respondents never have a difficulty in properly preparing foods, wash, and cook. However, Questions 1(hard time using mobile phones or tablets), 2 (squinting when sewing or threading a needle), 3 (able to do well with handicrafts), and 4 (properly repair items that needed to be fixed), with a rating of 94.74%, 84.21%. and 78.95%, respectively, with an interpretation of Never. This implies that respondents never have difficulty in repairing items, using mobile phones or tablets, doing handicrafts, and sewing and threading a needle.

1.3. Non- reading tasks: Hobbies

Table 6. *Summary of the descriptive statistics on status of the subjects after using the near prescription reading glass in terms of hobbies*

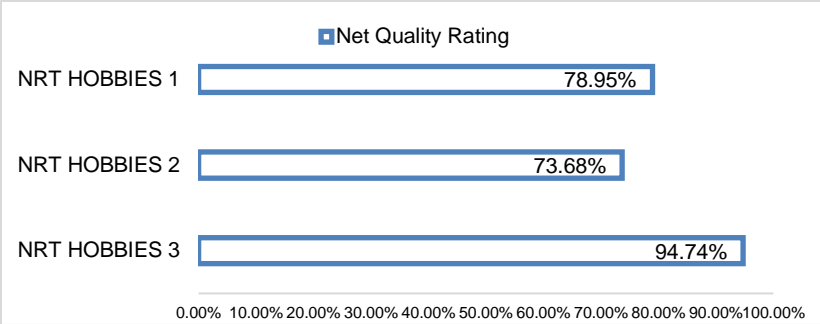


Table 6 shows the status of the near vision tasks of the subjects after using the prescription reading glasses in terms of hobbies. Based on the responses, Question 3 (blurring of vision when answering newspaper or when playing mobile games) ranked first with a net quality rating of 94.74% and recorded an interpretation of Never. This means that respondents never suffer blurring of vision when answering newspaper or playing mobile games. However, Questions 1 (able to play cards, chess and domino) and 2 (blurring or doubling of vision while cross stitching) ranked at the bottom, with a net quality rating of 78.95% and 73.68%, respectively, with an interpretation of Never. This implies that respondents never have difficulty playing cards, chess, and domino well and blurring or doubling of vision while cross stitching. Overall, the majority of respondents rate the individuals' performance doing their hobbies as Excellent after using the close prescription reading glasses.

Table 7. *Related Samples Wilcoxon Signed Rank Test on Reading Task*

Measure 1	Measure 2	P	Decision
Before the prescription glass	After the prescription glass	< .001	Reject the null hypothesis
The significance level is 0.05			

Table 7 reveals that the estimated p-value (<0.001) is less than 0.05, thus, the null hypothesis. is rejected. This indicates that the respondents' prescription glasses are effective for their reading task.

Table 8. *Related Samples Wilcoxon Signed Rank Test on Working Task*

Measure 1	Measure 2	P	Decision
Before the prescription glass	After the prescription glass	< .001	Reject the null hypothesis
The significance level is 0.05			

Table 8 reveals that the estimated p-value (<0.001) is less than 0.05, thus, the null hypothesis is rejected. This indicates that the respondents' prescription glasses are effective for their non reading tasks at home and at work.

Table 9. *Related Samples Wilcoxon Signed Rank Test on  
Hobbies*

Measure 1	Measure 2	P	Decision
Before the prescription glass	After the prescription glass	< .001	Reject the null hypothesis
The significance level is 0.05			

Table 9 reveals that the estimated p-value ( $<0.001$ ) is less than 0.05, thus, the null hypothesis is rejected. This indicates that the respondents' prescription glasses are effective for their hobbies.

## DISCUSSION

Overall, the near vision tasks status of the subjects prior to the giving of the prescription reading glasses, the respondents had good near eyesight prior to receiving the prescription reading glasses for reading tasks. In contrast, the study of Goertz, et al. (2013) stated that presbyopic patients treated with reading spectacles had lower quality of life metrics than those who were younger and emmetropic. Additionally, daily activities are more difficult to complete without close reading correction.

For home and work tasks, respondents had fair near eyesight prior to receiving the prescription reading glasses. This is further provided and supported by the study of Berdahl, et al. (2022) which showed that 80% of patients with uncorrected presbyopia had difficulties with near – vision related tasks. Respondents also had poor near eyesight prior to receiving the prescription reading glasses for hobbies, as indicated in the study of Sherwin, J. C., et al. (2008), that is, respondents also experienced difficulty in reading messages in their mobile phones, cross stitching, and even playing games such as chess.

After giving of near prescription glasses, respondents report never have difficulty reading small prints, such as in newspapers and magazines, experience blurring of vision when reading labels or instructions on medicine bottles or food packaging, experience blurring of vision when reading prints from electricity and water bills, bank statements, and do not struggle to maintain focus on the reading material after prolonged near work for three (3) hours or more. Majority of respondents rated the individuals' reading performance as Excellent after using the close prescription reading glasses. The findings reveal beneficial effects of near correction and extremely high levels of satisfaction with it. The participants' favorable experience is reflected in the substantial effect sizes found in the questionnaires. Respondents suggest reading glasses to those who have trouble seeing objects at close distance and desiring to have sense of independence in using devices by using corrective spectacles. (Laviers, et al, 2010)

On the other hand, Majority of respondents rate the individuals' non-reading performance: home and work tasks as Excellent after using the close prescription reading glasses. Ahmed, S. M., & Islam, Q. S. (2009) stated that the majority of those who currently wear reading glasses noticed an improvement in regular housekeeping tasks in addition to their work-related activities. A sizable percentage of the patients said that their income and working hours had also grown after wearing reading glasses; a vast majority more than 90% of them said they could work comfortably using reading glasses. Also, most patients reported that there had been some progress in some routine tasks including, cooking, cleaning fish bones while eating, reading, writing, and doing other activities since they began utilizing reading glasses.

Furthermore, the qualitative portion of the pre – near activity questionnaire aimed to identify what challenges and problems were faced without their prescription glasses, as well as on how did they cope up with such challenges and problems that they faced. Looking at Pre-Questionnaire results, patient's uncorrected vision impacted their near vision tasks such as reading, writing, and non-reading tasks without any correction. Sherwin, J.C. et.al. (2008) included how near vision affects different activities, near vision issues, wearing glasses, and past

interactions with eye care specialists were among the questions posed.

Based on the answers of the respondents after using the near prescription glasses, they experienced better vision when reading and writing as well as easy to perform near vision tasks related to their work or hobby. Ahmed, S. M., & Islam, Q. S. (2009) stated that the majority of those who currently wear reading glasses noticed an improvement in regular housekeeping tasks in addition to their work-related activities. Most patients reported that there had been some progress in some routine tasks including, cooking, cleaning fish bones while eating, reading, writing, and doing other activities since they began utilizing reading glasses.

## Conclusion

Based on the findings of the study, the following conclusions were drawn:

- 1        There is a significant effect of prescription reading glass to presbyopic patient's reading tasks.
- 2        There is a significant effect of prescription reading glass to presbyopic patient's non- reading tasks.
- 3        There is a significant effect of prescription glasses to presbyopic patient's hobbies.

## Recommendations

**For the Sitio Bisaya residents** – The results of the study will provide the basis of what would be the proposed vision care program shall be done within the community. This will further help the residents to have an additional care with their vision.

**For the local government unit (LGU)** – The local government unit may use the results of the study to identify what changes occurred after the residents were given their prescription reading glasses. This can serve as a reference or basis for the LGU's future healthcare programs which may include vision care.



**Optometrists and Ophthalmologists** – Since the results of the study will provide the Optometrists and Ophthalmologists within the area information that such prescription glasses are beneficial to the residents, particularly those who are indigent, they can identify what services and support they can give to the residents not only within the area of the study, but as well as to similar communities with the same situation.

**Families** – The families within the community, especially those who are related with the respondents of the study, should be more aware especially on taking care of relative/s with presbyopia and to guide them, and to further promote vision care even after the dispensing of prescription reading glasses. The families with no relatives from the respondents on the other hand should also be aware of the importance of vision care

**Optometry Students** –The Optometry students of Emilio Aguinaldo College Cavite School of Optometry will use the results of the study to be able to keep the data and information of the residents who were examined and given prescription reading glasses. The Optometry students can follow them up for the purpose of checking on them, as well as with the possibility of utilizing them as participants to future research.

**Future Researchers** – The future researchers may use the results of the study to further continue the current study, and further improve the gaps within the study. The future researchers will also be provided with a new set of respondents as the population will further age, and those that will need vision care will further increase.

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