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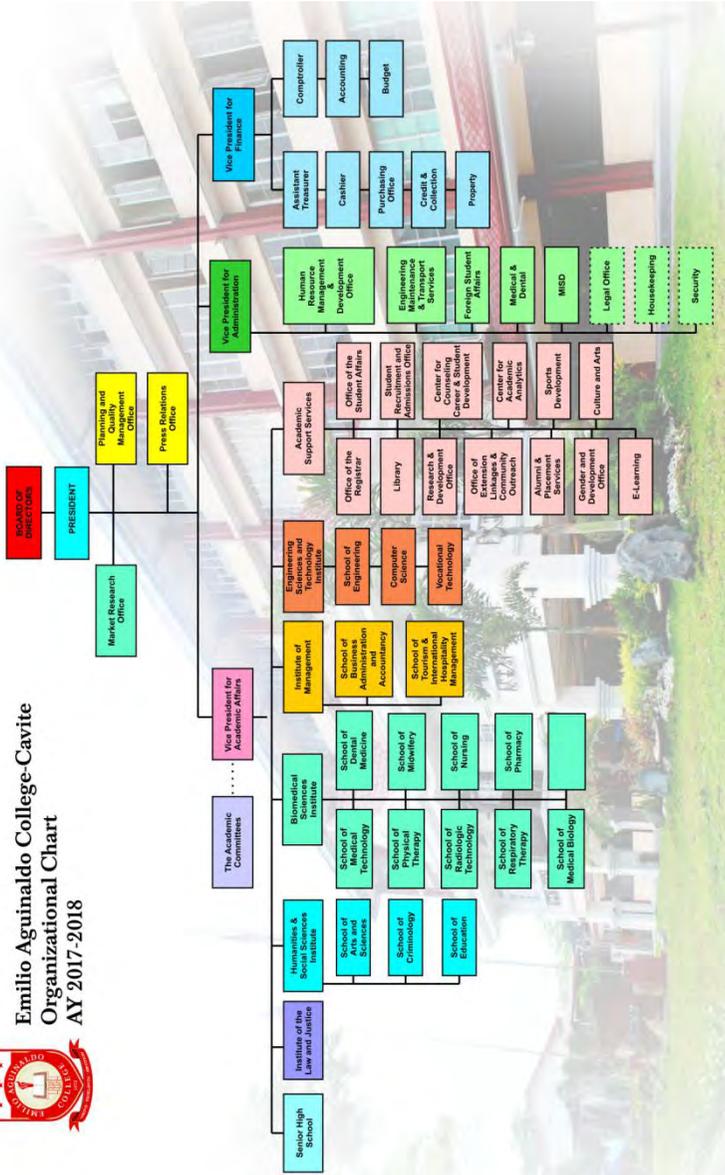
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# EAC ORGANIZATIONAL CHART



## Emilio Aguinaldo College-Cavite Organizational Chart AY 2017-2018



## **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. (GEAMSFI) 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.

## **EDUCATIONAL OBJECTIVES**

The objectives of Emilio Aguinaldo College are to:

- offer opportunities for quality and relevant education to all;
- cultivate the intellectual, spiritual, moral, social and physical aspects of a person;
- instill appreciation and pride for one's national identity; and
- produce graduates of global quality equipped with competencies in their field of expertise.

## **QUALITY POLICY**

Emilio Aguinaldo College commits to the continuous improvement of quality standards with emphasis on instruction, research and community service to benefit its stakeholders.

## **QUALITY OBJECTIVES**

The objectives of the Emilio Aguinaldo College are to:

- Adhere to all statutory and regulatory standards;
- Provide consistent quality service to the students, parents and other stakeholders; and
- Respond to periodic system review for continual improvement on quality standards.

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# Hemagglutinating activity of string beans lectin (*Phaseolus vulgaris*) on different blood groups

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## Abstract

This study aimed to determine the hemagglutinating activity of *P. vulgaris* on type “A” cells in its crude form, and to analyze whether the hemagglutination reaction produces same results using crude extract of lectin through manipulation of different red blood cell dilutions. Specific trademark of lectins grants itself as carbohydrate-binding proteins which bind to glycoproteins, glycolipids, and also polysaccharides. Results revealed ABO blood group showed a significant reaction upon treatment of lectin from a red cultivar of *Phaseolus vulgaris*. A 2:1 dilution (3.33 mL Extract to 1.67 mL PBS) showed the highest degree of agglutination. Findings of this study classified *P. vulgaris* extract as a fairly weak agglutinin which may be due to the abundant fractions of non-lectin substances present in the extracted solution. Blood type played no significant association to the ability of the extract to agglutinate red cells. These differences seem to be due to genetic variations among the cultivars of *P. vulgaris* lectin. Furthermore, results showed that there is a significant negative strong correlation between the dilution and the ability of the extract to agglutinate red cells based on the results of the Spearman Rho test,  $Rho(72) = -.887, p=.000$ ,

**Keywords:** hemagglutinating, blood groups

## Introduction

Blood banking in the laboratory currently use blood typing sera to define an individual's blood type. Lectin or the molecules present in the typing sera caused hemagglutination reaction on whole blood. Lectin, a glycoprotein capable of attachment unto different carbohydrates (specifically monosaccharides) and commonly used to detect red cell antigens. These can be extracted from different sources like fruits, vegetables, beans and seeds (Lis & Sharon, 1986). The commercial blood typing sera can detect the antigen present in the surface of red cells, thus, typing sera contains antibody for lock-and-key relationship to occur.

Lectins defined as proteins or glycoproteins possessing at least one non-catalytic domain which binds reversibly to a specific mono- or oligosaccharide (Jebor and Jalil 2012). The word Lectin has been derived from the Latin word which means choose, because its specificity to the site where it binds (Bhol 2012). Lectins widely distributed in nature and found in all forms of life including plant products such as fruits, vegetables but nuts, grains, beans and seeds contains high lectin amount (Lis and Sharon 1986). Researchers have great interest and lectins have been studied and isolated from various sources including plants, animals, fungi, lichens and bacteria.

Because of its sugar binding properties, lectins have been extensively studied and used as molecular tools for the study of carbohydrate architecture and dynamics on the cell surface (Jebor and Jalil 2012). This specific trademark of lectins grants itself as carbohydrate-binding proteins which bind to glycoproteins, glycolipids, and also polysaccharides. These proteins can be classified into many groups such as mannose-binding, glucose-binding, N-galactose-binding, N-acetylgalactosamine-binding, N-acetylgalactosamine-binding, fucose-binding, and sialic acid-binding (Bhol 2012). In addition, they have non-immune origin and can bind to the above mentioned biochemical compounds without changing their covalent structure.

Lectins can be used as probes for the characterization and isolation of simple and complex sugars. Furthermore, these proteins were characterized for their agglutination properties with erythrocytes of human and other animals, it is the easiest and most convenient method of detection of lectin activity (Laija et al. 2010). As antigenic determinants of blood group, these proteins have come to be important tools in the identification of different blood groups antigens. A handful of lectins may be considered excellent reagents for anti-A, anti-B, anti-N etc, (Khan 2006). These proteins along with antibodies may be used as markers for the detection of basal cells in the human respiratory

epithelium. Furthermore, they suggest that the glycosylation of some glycocomponents of the basal cells is under the control of the genes of the secretor- and ABO-blood group system.

Blood typing sera was derived from legumes to where it has specific reactions. For anti-A; *Dolichus biflorus* lectin was used, from *Bandeiraea* (now *Griffonia simplicifolia*); anti-B was derived (Gorakshakar & Ghosh, 2016). For this study, the lectin derived from *Phaseolus vulgaris* (string beans) was used for it is abundant in the Philippines for consumption use. According to Laura Power (2006), Purified *P. vulgaris* is specific for blood type “A”.

Purification process as the ideal method to properly extract the lectin present in beans. Since it required immense amount of time to employ and still use advanced technology, this study focused on the crude extraction process that utilized lesser time to acquire results. Although crude extract yielded non-purified mixture, it was still tested to determine whether it can produce potent reaction as to purified one. Some literature claims *P. vulgaris* can agglutinate type “A” cells in its purified form, therefore, this study aimed to analyze whether the hemagglutination reaction produces same results using crude extract of lectin through manipulation of certain variables.

## Materials and Methods

Descriptive comparative research design was utilized in this study since it did not use a control for standardization and variables were manipulated to achieve desired results. It is done to determine whether the (1) varying dilutions of seed extract of *P. vulgaris* and phosphate buffered saline, (2) different concentrations of ABO blood group red cell suspension can readily affect the degree of hemagglutination reaction on human erythrocytes.

String beans (specifically white cultivar) were collected from a market in Dasmariñas City, Cavite. Most of the processes are done at School of Medical Technology laboratory, Emilio Aguinaldo College – Cavite and some at Angelo King Research Institute De la Salle University Medical Center. The study started from October 2016 to March 2017.

The study was divided into three parts: preparation of seed extract, crude extraction and hemagglutinating assay. Preparation of seed extract includes (1) uncoating of three kilograms of string beans and grinded to desired consistency, (2) preparation of PBS with a pH of 7.2, (3) blood extraction which took one sample from each ABO blood group, (4) and preparation of 3%-5% of red cell suspension.

## Crude Extraction

Crude extraction process constituted addition of 1000 mL of 95% of ethanol to 500 grams of grinded seed and incubated for three days. After incubation, it was then filtered and solvent was separated from the extract using rotary evaporator yielding 150 mL of crude extract. 1:10 dilution of DMSO was added to the extract to eliminate unnecessary substances that were not removed by ethanol. Preparation of varying dilutions of crude extract and PBS were made (2:1; 1:1; 1:2; 1:4; 1:6; 1:8).

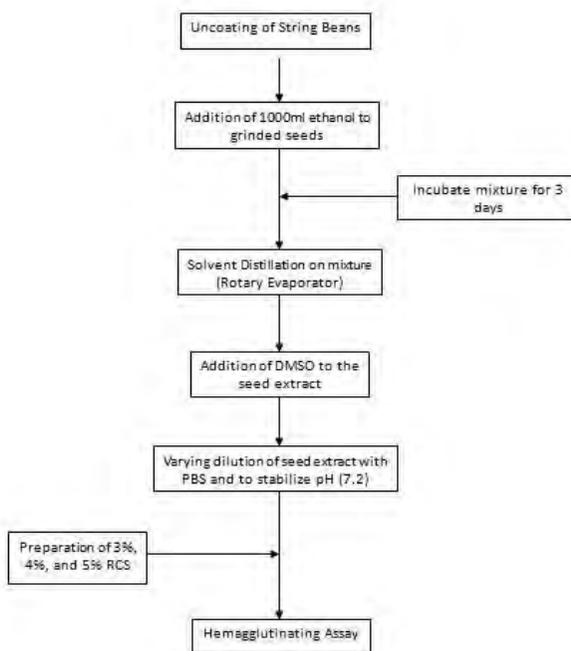


Figure 1. Flowchart of the experimental methods of the study

## Hemagglutinating Assay

Hemagglutinating assay included testing of different concentration of RCS (3%-5%) of each ABO blood group with varying dilutions of extract using tube method. A volume of 100 ul of extract was mixed with 50 ul of RCS in a tube, centrifuged for,500 rpm for 1 minute, dislodged and viewed under microscope for microscopic reactions.

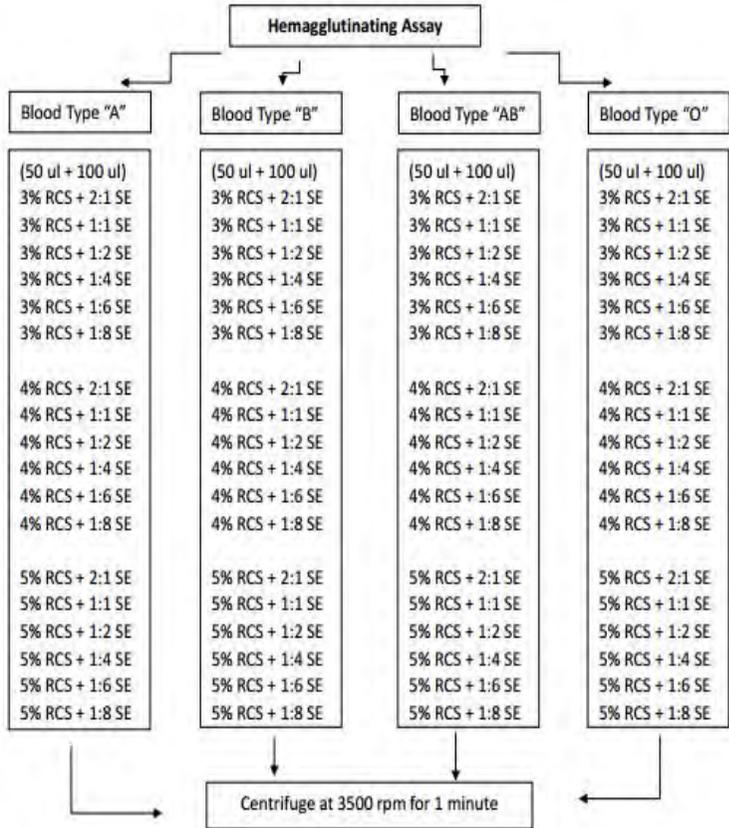


Figure 2. Hemagglutinating Assay

### Data Analysis

One-way ANOVA was used to determine if there is a significant difference on the degree of agglutination of *Phaseolus vulgaris* across different Blood groups and dilutions. A chi square was made to test the presence of significant association between: blood types and the ability of the extract to agglutinate red cells; dilutions and the ability of the extract to agglutinate red cells; red cell concentrations and the ability of the extract to agglutinate red cells. Spearman Rho was used to determine the presence of significant relationship between the blood types and the ability of the extract to agglutinate red cells.

Table 1

*Agglutination Grade of the Extract Across Different Blood Groups (n=71)*

Blood Group	Mean Agglutination	Standard Deviation	dF	F	p Value	Interpretation
A	.667	.77	71	.711	.549	Not significant
B	.779	.88				
AB	.889	.96				
O	.500	.71				

One-way ANOVA of the four blood groups showed no significant difference on the level of agglutination,  $F = 0.711$ ,  $p = 0.549$ .

Findings were consistent with the study of Jebor and Jalil (2012) where all the blood types under the ABO blood group showed a significant reaction upon treatment of extracted lectin from a red cultivar of *Phaseolus vulgaris*. Lectins of both studies show no specificity on the blood type it reacts to. Though characteristics of *P. vulgaris* cultivars vary extensively in the lectins it contains, similarities are observed in the white and red variants.

In the absence of further purification studies, data on characterization of in-vitro hemagglutination assay suggested that the same erythrocyte-reactive subunits were present in both white and red cultivars of *Phaseolus vulgaris*, in congruence to the findings of Jebor and Jalil (2012).

**Degree of Agglutination of *Phaseolus vulgaris* Across Different Dilutions**

Table 2

*Agglutination Grade of the Extract with Varying Dilutions of Red Cells*

Dilutions	Mean Agglutination	Standard Deviation	dF	F	p Value	Interpretation
2:1	1.92	.29	71	82.378	.000	Significant
1:1	1.42	.51				
1:2	.92	.51				
1:4	0	0				
1:6	0	0				
1:8	0	0				

A 2:1 dilution (3.33 mL Extract to 1.67 mL PBS) showed the highest degree of agglutination. There was a decreasing trend in mean agglutination from the dilution of highest extract concentration (2:1). One-way ANOVA showed that there is a significant difference on the

degree of agglutination on blood cells across different dilutions,  $F = 82.378$ ,  $p = 0.00$ .

The decreasing trend found with similarity to the findings of Chandra (2012) in the isolation and characterization of *Glycine max* lectin where the concentration of the extract is directly proportional to the degree of hemagglutination (higher grades of reaction can be observed in higher extract concentrations). The findings of this study classified *P. vulgaris* extract as a fairly weak agglutinin which may be due to the abundant fractions of non-lectin substances present in the extracted solution. The observed fairly weak agglutination is similar to the findings of Leher (2000) in lectin-mediated drug delivery wherein he pointed out minimal immune complex formation as a result of low extraction rates of lectin present in *P. vulgaris* seeds.

Post-Hoc analysis using Least Significant Difference showed that there is a substantial difference in reaction between the cells treated with 2:1, 1:1, and 1:2 dilutions in contrast to 1:4, 1:6, and 1:8 dilutions.

### Association between the blood types and the ability of the extract to agglutinate the red cells

Table 3

*Cross-tabulation showing the association between blood type and agglutination grade (n=72)*

Blood Type	Agglutination Grade			df	Chi Square	p Value	Interpretation
	0	+1	+2				
A	9	6	3	6	5.845	.441	Not significant
B	9	4	5				
AB	9	2	7				
O	11	5	2				

Given that hemagglutination is present in all of the cell suspensions, Blood type played no significant association to the ability of the extract to agglutinate red cells. The result found to be linear to the findings of Perrone and Moreira (1977) that lectin from *Phaseolus vulgaris* interacted with 0.85% NaCl suspension of red blood cells from the ABO group system shows no differences. Lack of both group specificity and sugar inhibition seems to be a characteristic of lectins from various cultivars of *P. vulgaris*.

A study on the preliminary immune function studies on *P. vulgaris* lectin by Yanyan, Guang Qin, and Jichang Li (2010) supported the existence of more than one isolectins found in white cultivars. They classified the isolectins based on the specific blood cells they react.

Erythrocyte reactive subunits are responsible for hemagglutination of red blood cells while lymphocyte-reactive subunits are the ones that influence the mitotic activities of white blood cells. The study was able to determine the presence of five isolectins: L4, L3E1, L2E2, L1E3, and E4 in the *P. vulgaris* extract. They were able to find out that an isolectin can either be specific (i.e. L4 and E4) or multifunctional (i.e. L3E1, L2E2 and L1E3).

Although the phaseolic lectins are somewhat similar in molecular weight and subunit structure, differences in carbohydrate content, physicochemical and biological properties have been reported. According to Jebor and Jalil (2012), these differences seem to be due to genetic variations among the cultivars of *P. vulgaris* lectin. The existence of more than one lectin in a single source is not uncommon and among such sources are some varieties of *P. vulgaris* lectin reported by Takahashi et al. (2010).

### **Association between the dilutions and the ability of the extract to agglutinate the red cells**

Table 4.1

*Cross-tabulation showing the association between dilution and agglutination grade (n=72)*

Dilution	Agglutination Grade			df	Chi Square	p Value	Interpretation
	0	+1	+2				
2:1	0	1	11	10	94.96	.000	Significant
1:1	0	7	5				
1:2	2	9	1				
1:4	12	0	0				
1:6	12	0	0				
1:8	12	0	0				

## **Result and Discussion**

### **Degree of Agglutination of *Phaseolus vulgaris* Across Different Blood Groups**

The degree of agglutination was determined using Schroeder's (2005) standard. The reactions were graded as follows: 4+ (one solid aggregate or clump of cells), 3+ (several large aggregates), 2+ (small to medium sized aggregates), 1+ (small aggregates), and Mixed Field (any degree of agglutination in a sea of unagglutinated cells).

The formation of immune complex (hemagglutination) is the positive indication that active lectins are present in the extract. For this phenomenon to take place, there must be an optimum concentration of the reacting antibody (lectin) and antigen (sugars attached on the blood cell surface). Determination of the minimum and optimum concentration to where an immune complex takes place must be established to assess the strength of the active lectins in the extract with given consideration to prozone (excess of antibodies) and postzone (excess of antigens) reactions.

In this study, dilutions are formulated to determine the significant concentration in agglutination reactions.

Table 4.2

*Summary of the Actual Volume of Concentrations in 100 ul P. vulgaris extract of against 50 ul of Red Cell Suspension (2:1 Treatment)*

Dilution	Extract to PBS volume ratio in 5 ml buffered solution	Actual volume in 100 ul buffered solution	Agglutination
2:1	3.33 ml Extract : 1.57 ml PBS	66 ul	+
1:1	2.50 ml Extract : 2.50 ml PBS	50 ul	+
1:2	1.57 ml Extract : 3.33 ml PBS	33 ul	+
1:4	1.00 ml Extract : 4.00 ml PBS	20 ul	-
1:6	0.83 ml Extract : 4.17 ml PBS	17 ul	-
1:8	0.56 ml Extract : 4.44 ml PBS	11 ul	-

There is a significant association between the Phosphate buffer dilutions and the ability of the extract to agglutinate red cells. 2:1 dilution showed the highest degree of agglutination (66 ul P. vulgaris extract against 50 ul of Red Cell Suspension).

Our study showed that equal to or greater than 33 ul of extract can facilitate a significant immune complex formation against a 50 ul red cell suspension. Similar observations were gathered in the study of Singh, Saikrishnan, Kumar, and Dauter (2004) showing optimum reaction at 1:2 dilution (extract to cell ratio).

#### **Association between the Red cell concentration and the ability of the extract to agglutinate the red cells**

Table 5

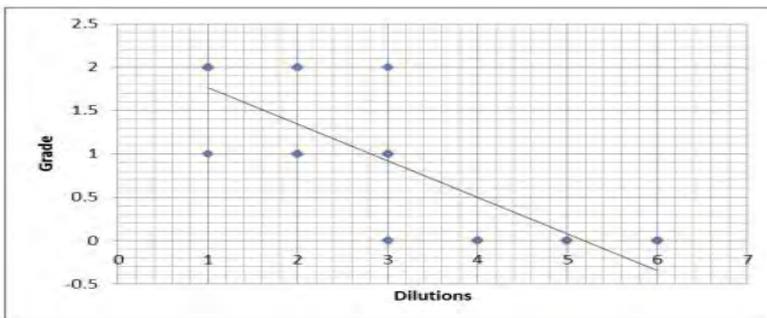
*Cross-tabulation showing the association between RBC concentration and agglutination grade (n=72)*

RBC Concentration	Agglutination Grade			df	Chi Square	p Value	Interpretation
	0	+1	+2				
3%	13	7	4	4	1.347	.853	Not significant
4%	13	5	6				
5%	12	5	7				

Hemagglutination is dependent on the optimum quantities of the antigen and antibody present in the reaction. The quantities of antigens present in the surface of the red cells remain constant with the presence of varying concentrations. Chi square showed no significant association between RBC concentration and agglutination grade,  $df = 4$ ,  $p = 0.853$ .

Although studies revealed that ratio of serum to red cells can greatly affect the sensitivity of agglutinating tests (Sultan, 2013), the antigens present in the red cells are potent and considered a sole source of a strong reaction that produced significant result regardless of red cell's concentration in a suspension. This observation is linear to the study of Wong (2006) in the purification and characterization of a galactose-specific lectin from Pinto beans. His study focused on the specificity of lectin on blood type A samples. His study made use of varying red cell suspensions for hemagglutination assays.

**Relationship between the grades of agglutination and dilutions of the extract**



*Figure 3. Scatter plot showing relationship between the grade of agglutination and dilution*

There is a significant negative strong correlation between the dilution and the ability of the extract to agglutinate red cells based on the results of the Spearman Rho test,  $Rho (72) = -.887$ ,  $p = .000$ , two tailed.

Parallel to the results shown above, a study was published supporting the fact that the more concentrated the reactants, the more the chance of successful collision between two substances present in a mixture (Brown, 2017). This is influenced by the avidity or the sum of all initial forces (affinity) between the antigen and the antibody present in the reaction. The affinity constant ( $K_a$ ) is the inverse of the dissociation constant ( $K_d$ ). The strength of complex formation in solution is related to the stability constants of complexes, however in case of large biomolecules, such as receptor-ligand pairs, their interaction is also dependent on other structural and thermodynamic properties of reactants plus their orientation and immobilization. Therefore, the more concentrated the extract (lesser dilution), the stronger the grade of agglutination is observed.

## Conclusion

Pool of unnecessary substances retained in non-purified mixture is a possible source of interference in the results of any processes.

In this study, purification processes are excluded in the experimentation and crude extract from *Phaseolus vulgaris* are examined to test its capability to produce specific reaction on ABO blood groups. Entire processes showed that there is a non-specific reaction supported by the data gathered from the experimentation. Hemagglutinations were present in all ABO blood types despite the manipulation of variables including the dilutions of PBS with extract and preparation of different concentrations of red cell suspension. However, the table showed significant association between the dilutions of the extract and its ability to produce reaction on red cells. 2:1 dilutions of extract demonstrate highest hemagglutination reaction with a grade of +2 on all ABO blood groups while leaving the concentration of red cell suspension non-significant in providing accurate results.

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# ***In-vitro* inhibitory activity of *Gallus gallus domesticus* in quorum sensing of *Pseudomonas aeruginosa* from used catheters**

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## **Abstract**

The study determined the inhibitory activity of *Gallus gallus domesticus* IgY (Avian IgY) against *Pseudomonas aeruginosa*'s pyoverdinin formation and swarming motility. Avian IgY undergone quorum sensing screening through prodigiosin inhibition of *Serratiamarcescens*, a biosensor organism. After the screening, Avian IgY with varying concentrations (20 mg/mL, 10 mg/mL, 5 mg/mL and 2.5 mg/mL) proceeded to quorum sensing inhibition. Pure DMSO served as positive control, and 20 mg/mL and 10 mg/mL which were used able to inhibit the pyoverdinin pigment. Results were obtained by measuring the pyoverdinin clearing zones (opaque color) within the periphery of the disk and by measuring length reduction of swarming. The relationship between the varying concentrations of Avian IgY in inhibiting pyoverdinin when compared to positive and negative control were statistically significant with a  $p = .000$  ( $p < 0.05$ ) using one-way ANOVA. Based on the linear regression, a concentration of Avian IgY is a significant predictor of pyoverdinin inhibition with a  $p = .003$  ( $p < 0.05$ ). It can infer that as the concentration of Avian IgY increases, the zone of inhibition of pyoverdinin increases as well. On the other hand, Avian IgY in length reduction of swarming motility when compared to control showed a significant difference with a  $p = .000$  ( $p < 0.05$ ) using T-test. Therefore, results and data obtained suggest that Avian IgY could inhibit quorum sensing of *P. aeruginosa*.

**Keywords:** Avian IgY, quorum sensing, pyoverdinin, swarming motility

## Introduction

Hospital-acquired infection (HAI), also known as nosocomial infection, had been a serious concern in public health and even an immense and major problem in hospitals worldwide. Increasing prevalence of mortality rate due to this infection caught the attention of the people concerned. Among all the healthcare associated infection, 12% accounted for catheter-associated urinary tract infection (CAUTI), which is an infection occurring in urinary tract mainly caused by bacterial colonization specifically by *Pseudomonas aeruginosa*. The bacterium is a gram-negative rod, and non- lactose fermenter commonly attributed with pyoverdinin for pigmentation, a flagellum responsible for swarming motility, and a quorum sensing gene (Krishnan et al, 2012). According to Jacobsen S. M. et al (2008), some bacteria like *P. aeruginosa* have the ability to adhere to urinary catheters, which instigating microbial communication leading to the expression of virulent biofilm.

Quorum sensing or a bacterial mechanism that influences the formation of biofilm on the surfaces of indwelling devices (Li &Tian, 2012; Nazzaro et al, 2013) and might be composed of different microorganism (bacteria, fungi, etc.). It served as their protective mechanism against antimicrobial agents and host immune response (Butler MT, 2010; Zhou et al, 2015). Galloway, W. et al (2011) stated that quorum sensing facilitates retention of pathogenic microorganism and its subsequent proliferation, weakening host immune system and making the organism resistant thus, posing a life-threatening infection. For the patients undergoing catheterization, the risk of acquiring the infection increases each day (Faneley et al, 2011; Nicolle LE, 2014) for when urinary catheter started its insertion that could immediately developed into biofilm (Declaru et al, 2016) and a great tendency for the microorganisms to ascend its colonization which cannot be solely prevented unless quorum sensing is inhibited (Amalaradjou et al, 2013).

Recent advancement in technology had developed a biomaterial that is not invasive, inexpensive, and at the same time, can potentially decrease the antibiotic prescriptions- the Avian IgY (Diraviyam et al, 2014; Muller et al, 2015). Avian IgY, the major immunoglobulin class present in egg yolk of *Gallus gallusdomesticus*, considered to be an alternative of mammalian IgG (Dubie et al, 2015), believed to inhibit the formation of biofilm in a patient with cystic fibrosis caused by *Pseudomonas aeruginosa* (A. Michael et al, 2010; Asemota et al, 2013). Furthermore, *Streptococcus mutans*, a gram-positive coccus which has the specific ability to form a virulent dental plaque, was prevented through the use of mouth rinse and toothpaste incorporated with Avian

IgY (Irwandi et al, 2012; Bachtiar et al, 2016). Thereby, inhibition of adherence property of the bacteria by the Avian IgY could restrain the bacterial communications at the same time, the formation of biofilm (Gandhimathi et al, 2015).

These previous researches attested the efficacy of Avian IgY against the quorum sensing. In this study, Avian IgY from the egg yolk of *Gallus gallus domesticus* and was used as a quorum sensing potential inhibitor against *Pseudomonas aeruginosa* isolated from used urinary catheters.

Inhibitory activity of Avian IgY was screened by inhibiting the prodigiosin of *Serratiamarcescens*. Varying concentrations of the antibody were subjected in pyoverdine inhibition after the QS screening. The study determined the concentration of Avian IgY in inhibiting the pyoverdine pigment of *P. aeruginosa*, whether concentration of Avian IgY could serve as significant predictor of pyoverdine inhibition and the significant difference of varying concentration of Avian IgY in pyoverdine inhibition and in length reduction of swarming motility when compared to positive and negative control.

## **Methodology**

### *Isolation of Bacteria*

Used catheters collected from tertiary public hospital were cut aseptically into 3-5 centimeters. The catheter tips with possible quorum sensing activity were inoculated on Trypticase Soy Broth (TSB) for 24 hours at 37 °C under aerobic condition. Turbid broth after the 24 hours incubation indicated the growth of bacteria. Bacteria were planted directly on different agar plates and incubated at 37°C. Purity of the culture was checked and further verified through VITEK 2 automated method (Kwansy, SM and Opperman, TJ, 2010).

### *AVIAN IgY*

*Gallus gallus domesticus* immunoglobulin Y (IgY) was purchased from Gallus Immunotech Inc., a company producing egg-derived antibodies. The Avian IgY was purified from the eggs of unimmunized chickens. It was approximately 85-90% pure which purified through SDS polyacrylamide gel electrophoresis (SDS-PAGE) method. The extracted and purified antibody on liquid state having a volume of 0.5 milliliters with a concentration of 20.0 mg/mL. was utilized in the test sample.

### *Antibody Serial Dilution*

Three sterile microtubes with 100 uL Normal Saline Solution (NSS/ 0.9% NaCl) was used for the antibody serial dilution and labeled 1:2, 1:4 and 1:8. A measurement of 100 uL of concentrated Avian IgY (20 mg/mL) was pipetted, dispensed and mixed with NSS on the first tube (1:2) which yield a concentration of 10 mg/mL. From the 1:2 tube, 100 uL was aspirated and transferred unto the second tube (1:4) and it produced 5 mg/mL. A 2.5 mg/mL concentration was produced when 100 uL from the 1:4 tube is transferred to the third tube (1:8). A 100 uL was aspirated and discarded. A volume of 100 uL of diluted Avian was used in each tube.

### *Quorum Sensing Screening*

Before testing the purified Avian IgY to quorum sensing inhibition, Avian IgY was subjected to qualitative quorum sensing potential screening. *Serratia marcescens* was used as the biosensor organism to determine whether the purified Avian IgY can proceed to quorum sensing inhibition.

A measurement of approximately 100uL of *S. marcescens* was inoculated on the Mueller Hinton Agar (MHA) using lawn technique method. Four different sterile blanks disks (6mm diameter) were impregnated into four different concentration of Avian IgY (20 mg/mL, 10 mg/mL, 5 mg/mL, and 2.5 mg/mL) and were placed on the lawned plates. Plates loaded with disks were incubated at 30°C for 24 hours. Anti-quorum sensing (Anti-QS) activity of the antibody was detected by inhibiting the prodigiosin pigment or the formation of colorless ring around the blank disk. Dimethyl sulfoxide (100% DMSO) served as positive control and blank disk as negative control. Positive result in screening test indicated that Avian IgY could proceed to quorum sensing inhibition.

### *Blank Disk Diffusion Assay*

The blank disk diffusion assay was used to determine the anti-Quorum sensing activity by evaluating zones of inhibition around the disk, in a similar fashion to a standard disk diffusion assay used for antibacterial susceptibility test. Assay was used to detect anti-QS activity of the Avian IgY extracts against isolated *Pseudomonas aeruginosa*'s pigment. A measurement of approximately 100uL of isolated *P. aeruginosa* was inoculated on MHA using lawn technique method. Four different sterile blanks disks (6mm diameter) impregnated

into four different concentration of Avian IgY (20 mg/mL, 10 mg/mL, 5 mg/mL, and 2.5 mg/mL) were placed on the lawned plates. Plates loaded with disks were incubated at 37°C for another 24 hours (Almeida et al, 2012).

Quorum sensing inhibition was detected by forming a faint and opaque color ring around the disk. Measurements were made after the incubation time from the outer edge of the disks to the edge of the zones of anti-QS activity. Dimethyl sulfoxide (100% DMSO) served as a positive control for anti-QS activity, and blank disk as negative control. Assay with the concentrated IgY (20 mg/mL) is done twice while diluted IgY was repeated into three independent triplicates.

### *Swarming Motility Assay*

The swarming motility assay was performed on swarming agar with the following composition: Glucose (1% wt/vol), Bacto agar (0.5% wt/vol), Bacto peptone (0.5% wt/vol) and Yeast extract (0.2% wt/vol) per 100 mL of distilled water. Swarming plates (small size petri dish (30x10)) was allowed to dry at room temperature overnight, before use. A 200  $\mu$ L of Avian IgY was seeded into 12 mL of the molten swarming agar. It was mixed well and gently dispensed unto petri dishes. Then, 40  $\mu$ L of *P. aeruginosa* overnight culture was inoculated at the center of the agar and incubated for 16-18 hours at 37 °C. Reduction in the length of *P. aeruginosa* swarming motility indicated an anti-QS activity of Avian IgY.

### **Data Analysis**

Descriptive Statistic, mean and standard deviation was used in determining inhibitory activity of Avian IgY in pyoverdinin. One-way ANOVA was used to determine degree of variance within and between groups and to substantiate the significant difference of varying concentrations of Avian IgY in inhibiting pyoverdinin pigment when compared to positive and negative control. Simple Linear Regression was used to determine the best fit line of different concentrations of Avian IgY correlating to the measurement of its zone of inhibition. On the other hand, T-test was used in determining significant difference of Avian IgY in swarming motility length reduction when compared to positive and in negative control.

## Result and Discussion

Table 1 showed the different treatment with their corresponding concentration of Avian IgY and the measurement of zone of inhibition of prodigiosin pigment of *Serratiamarcescens*. 100% DMSO (Positive Control) and concentrated Avian IgY (20 mg/mL) were able to inhibit prodigiosin. On the other hand, negative control, 5 mg/mL and 2.5 mg/mL of Avian IgY did not inhibit the pigment.

Since Avian IgY inhibited the pigment *S. marcescens* biosensor organism of quorum sensing, thus suggesting that Avian IgY served as a potential quorum sensing inhibitor.

Table 1

*Quorum sensing activity of Avian IgY against prodigiosin of Serratiamarcescens*

Treatment Group	Concentration	Prodigiosin Zone of Inhibition (mm)
Positive Control	100% DMSO	7
Negative Control	Blank Disk	0
Treatment 1	20 mg/mL Avian IgY	9
Treatment 2	10 mg/mL Avian IgY	8
Treatment 3	5 mg/mL Avian IgY	0
Treatment 4	2.5 mg/mL Avian IgY	0

The results were corroborated by the findings of Chenia (2013) wherein zones of inhibition in the pigment of two biosensor organism was observed after treating of varying concentrations of *Kigeliaafricana* fruit extracts. This could indicate that the varying concentration of the fruit extracts can serve as a potential quorum sensing inhibitor.

Furthermore, the findings affirmed by the study of Aparna et al, (2014) in which *S. marcescens* was used as biosensor organism to screen the quorum sensing inhibitory activity of dietary spice *Cinnamomumverum*. Zone of inhibition on the pigment of biosensor organism implied that the dietary spice had passed the qualitative screening and as a potential inhibitor of QS. Our study was also supported by the experiment done by Al-Haidari et al, (2016). The experiment graded the anti-QS potential of different medicinal plants based on zone of inhibition formed against to the biosensor pigment. Some of the plants showed no zone of inhibition was considered as

negative while other plants that exhibit zone of inhibition was considered as positive and continued to quorum sensing inhibition. Avian IgY through demonstrating clearing zone of prodigiosin was considered positive for anti-QS activity and therefore, could proceed to quorum sensing inhibition.

Table 2

*Pyoverdin Inhibition by varying concentration of Avian IgY*

Treatment Group	Concentration	Zone of inhibition			Mean	Standard Deviation
		Trial 1	Trial 2	Trial 3		
Positive Control	DMSO	17	12	8	12.3333	4.50925
Negative Control	Blank Disk	6	6	6	6.0000	0.0000
Treatment 1	20 mg/ml	25	21	—	23.0000	2.82843
Treatment 2	10 mg/ml	8	7	10	8.3333	1.52753
Treatment 3	5 mg/ml	6	6	6	6.0000	0.0000
Treatment 4	2.5 mg/ml	6	6	6	6.0000	0.0000

Table 2 showed the measurement of zone of inhibition of the pyoverdin pigment *Pseudomonas aeruginosa* after treating with 100% DMSO (positive control), negative control and varying concentrations of Avian IgY. Measurements were being represented by the mean values of 12.3 for positive control, 23.0 for 20 mg/mL Avian IgY, 8.3 for 10 mg/mL and 6.0 for negative control, 5 mg/mL and 2.5 mg/mL after three trials. Based on the result stated on the table, positive control, 20 mg/mL and 10 mg/mL of Avian IgY were able to inhibit the pyoverdin.

Avian IgY as a quorum sensing inhibitor did not demonstrate a clear zone of inhibition (antimicrobial activity) but rather, it exhibited an opaque color pyoverdin clearing zone within the periphery of the disc. The antibody did not kill or inhibit the microbial growth but it restrained the bacterial communication that when in the course of colonization could lead in the expression of virulence factors and antibiotic resistance. The findings were supported by the study of Ugurlu et al, (2015) wherein different phenolic compounds that passed in QS screening were subjected into quorum sensing inhibition against the pigment produced by *P. aeruginosa*. Phenolic compounds did not exhibit antimicrobial property but reduced the production of the pigment by forming an opaque clearing zone. Moreover, Norizan et al, (2013) asserted our findings where caffeine used as quorum sensing inhibitor. Caffeine yielded an opaque pyocyanin clearing zone within the periphery of the well by degrading the

autoinducers (AHL) produced by *P. aeruginosa*. The outcome entailed that the opacity in pyoverdin pigment surrounding the disk is tantamount to inhibitory activity of Avian IgY in quorum sensing of *P. aeruginosa*.

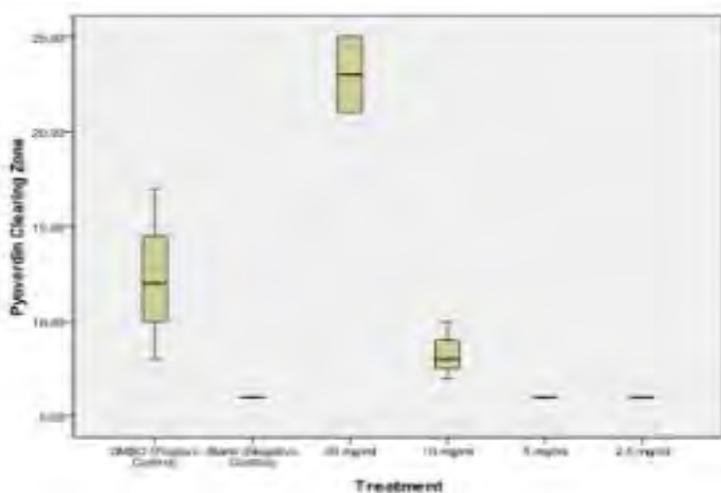


Figure 1. Box Plot of Pyoverdin Clearing Zone

Figure 8 illustrated the box plot of pyoverdin clearing zone after the treatment of positive (100% DMSO) and negative control (Blank Disk) and varying concentration of Avian IgY (20 mg/mL, 10 mg/mL, 5 mg/mL, 2.5 mg/mL). The positive control, 20 mg/mL (concentrated Avian IgY) and the 10 mg/mL of Avian IgY were able to inhibit pyoverdin pigment of *Pseudomonasaeruginosa*. On the other hand, lower concentrations of Avian IgY (5 mg/mL and 2.5 mg/mL) cannot inhibit the pyoverdin and showed activity comparable with the activity of negative control (blank disk).

Pyoverdin clearing zone and inhibition by Avian IgY was concentration- dependent. The results were congruent to the findings of Dietrich et al, (2006), wherein different concentrations of several plant extracts were subjected to quorum sensing inhibition of pyoverdin pigment of *P. aeruginosa*. Zone of inhibition was observed in positive control and in plant extracts with high concentration. The presence of zones of inhibition suggested the demonstration of the QS antagonistic activity of different plant extracts. Based on the the findings of Trivediet al, (2011), that substantiated the influence and the direct relationship of ascending concentrations of the different phytochemicals to the measurement of zone of inhibition (opaque color) of pyoverdin. Therefore, it can surmisethat as the concentration of Avian IgY increases, pyoverdin clearing zone increases as well.

Table 3

*Significant difference of varying concentrations of Avian IgY in pyoverdinin inhibition*

Treatment Group	Concentration	Zone of Inhibition (mm)			Mean	SD	df	F	P Value	Interpretation
		T1	T2	T3						
Positive Control	100% DMSO	17	12	8	12.3333	4.50825				
Negative Control	Blank Disk	6	8	8	8.0000	00000				
Treatment 1	20 mg/ml	25	21	—	23.0000	2.62843	5.11	20.745	.000	Significant
Treatment 2	10 mg/ml	8	7	10	8.3333	1.52753				
Treatment 3	5 mg/ml	6	6	6	8.0000	00000				
Treatment 4	2.5 mg/ml	6	6	6	6.0000	00000				

Table 3 showed the ANOVA table. The relationship between the mean of zones of inhibition of pyoverdinin to various treatment and concentration of Avian IgY gives an F value of 20.745 and p value= .000. This implied that there is a statistically significant difference ( $p < 0.05$ ) in the varying concentration of Avian IgY in inhibiting pyoverdinin when compared to positive and negative control thus, eliminating the type 1 error or false positive results. ANOVA validated the effect of Avian IgY in inhibiting the quorum sensing of the sample organism hence, the null hypotheses stating that varying concentration of Avian IgY has no significant difference in pyoverdinin inhibition when compared with positive and negative control is rejected.

As the one-way ANOVA indicated the significant difference in the varying concentration of Avian IgY and the zones of inhibition, a post hoc test using Least Significant Difference (LSD) was performed to compare the control with the varying concentrations of Avian IgY. Based on the post hoc analysis, the positive control (100% DMSO) shows a strongly significant difference with the 20 mg/mL of Avian IgY by giving a  $p = .000$  ( $p < 0.05$ ), a significant difference to 10 mg/mL with a  $p = .048$  ( $p < 0.05$ ), and to negative control, 5 mg/mL and 2.5 mg/mL with the same p value of .005 ( $p < 0.05$ ).

Thus, it can be inferred that the Avian IgY of 20 mg/mL is more superior in pyoverdinin inhibition compared to positive control, more so with the 10 mg/mL, 5 mg/mL, 2.5 mg/mL of Avian IgY and the negative control. Our study affirmed by the study of Akhand et al, (2014) on the

ability of Avian IgY to inhibit the quorum sensing activity of *Pseudomonas aeruginosa*.

Table 4

*Predictive model of P. aeruginosa treated with purified Avian IgY and its zone of inhibition*

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	22.355	3.453		6.475	.000
	Concentration	-4.790	1.214	-.796	-3.946	.003

Based on the results of linear regression table, the concentration of the Avian IgY is a significant predictor of pyoverdinin inhibition using this predictive model formula,  $y = a + \beta(x)$  whereas  $a = 22.355$ ,  $\beta = -.796$  and  $x$  is for the Avian IgY concentration. The predictive model is statistically significant giving a p value of .003 ( $p < 0.05$ ) that indicates Avian IgY concentration is a significant indicator of pyoverdinin clearin zone. Datar, (2014) study corroborates the result wherein different concentrations of indolylpyrimidines derivatives was used as *P. aeruginosa* zone of inhibition predictor which will compare to actual zone of inhibition using disk diffusion assay. As a result, future researchers will be allowed to predict and compute for the pyoverdinin zone of inhibition of *Pseudomonasaeruginosa* by just using the given concentration of purified antibody and through using the pre-determined formula of linear regression.

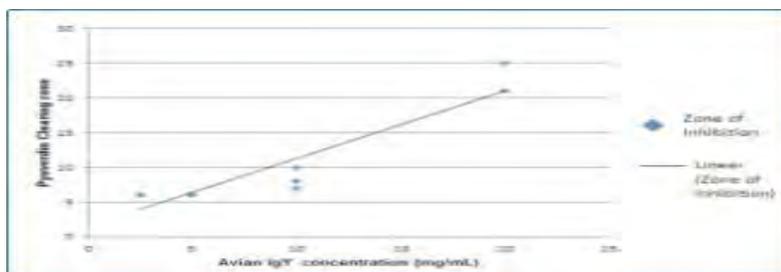


Figure 2. Scatter Plot of relationship of pyoverdinin zone of inhibition and varying concentration of Avian IgY

Shown in Figure 10 is a positive significant relationship between the zone of inhibition and varying concentration of Avian IgY based on the formula of predictive model. The pyoverdinin zone of

inhibition is directly proportional to the concentration of the avian antibody. This suggests that as the concentration of purified Avian IgY increases, pyoverdinin clearing zone will significantly increase as well. Results were congruent with the findings of Aparna et al, (2014), in which line graph was used to visualize the effect of ascending concentrations of dietary spices on the diameter of zone of inhibition. Conversely, decreasing or diluting the concentration of QS inhibitor is most likely to cause a weak reaction hence, could decrease the zone of inhibition.

Table 5

*Length Reduction of swarming motility by Avian IgY*

Treatment Group	Concentration	N	Mean	T	p value	Interpretation
Negative Control	-	5	349.7838	77.70700	.000	Significant
Positive Control	100% DMSO	5	23.5098	18.38300	.000	Significant
Treatment 1	20 mg/mL Avian IgY	5	334.8870	40.95400	.000	Significant

Table 5 showed the mean of in length reduction of swarming after the 5 times of measurement. As shown in this table, the concentrated Avian IgY exhibit a reduction in the measurement of *P. aeruginosa* swarming motility and it was determined by comparing the diameter of the swarming to the positive and negative control.

Based on the gathered data as written on the table, inhibition of *P. aeruginosa* swarming motility in the positive and negative control when compared the pure Avian IgY (20 mg/mL) shown a significant difference with a p value= .000 ( $p < 0.05$ ). The results are coherent with the research of Shrouf et al, (2006) and Martin et al, (2008), wherein the study shown an ability of different plant extract to exhibit inhibition of the swarming motility of *P. aeruginosa*. In relation to the study of Damte et al, (2013) he reported that inhibition or length reduction of swarming motility could inhibit quorum sensing. In this case, Avian IgY by decreasing the swarming motility could also inhibit quorum sensing.

## Conclusions

After obtaining the following data and results, the researchers drawn the following conclusions:

1. *Serratiamarcescens* can be used as biosensor organisms for quorum sensing inhibition of Avian IgY.
2. Only the 20 and 10 mg/ml of concentration can inhibit the pyoverdinin of *Pseudomonas aeruginosa*.
3. Avian IgY of 20 mg/ml is more superior in pyoverdinin inhibition than the positive control, more so with the 10 mg/ml, 5 mg/ml, 2.5 mg/ml and the negative control.
4. As the concentration of Avian IgY increases, the pyoverdinin inhibition will significantly increase as well.
5. A 20 mg/ml concentration of avian IgY can therefore significantly inhibit swarming motility.

## Recommendation

For the benefit of future related studies, the researches would like to propose the following:

1. Use other biosensor organisms such as *Chromobacterium violaceum* and *Agrobacterium tumefaciens*.
2. Explore the possibility of increasing the IgY concentration through immunizing the hen prior to antibody extraction
3. Use more purified antibody in testing for quorum sensing activity
4. Utilize varying concentrations of avian IgY (e.g. 10, 15, 20, 25 and 30 mg/ml) to enhance the standard equation model.
5. Optimize the conditions of the medium that will be utilized in swarming motility assay.

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# Development of intoxication detector based on false-color thermal imaging

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## Abstract

Existing drunk detector devices often use obtrusive if not invasive means. This paper presents an unconventional drunk detection approach based on real-time thermal imaging. The presented technique is the basis for the thermographic apparatus described in this paper. Using an infrared camera and a single-board computer, false-color features on the frontal face are extracted and evaluated to differentiate an intoxicated individual from a sober one. In order to determine the threshold feature between sober and intoxicated conditions, initial experimentation was conducted to measure the shift in thermal features between a person's face before alcohol consumption and after. It was revealed that alcohol intake causes positive shifts in the face's thermal features, especially in the nose region. Moreover, sober and intoxicated thermal features appear to be separable in the feature space. During detection process, the prototype employs OpenCV cascade classification to localize face and nose regions in each thermal frame. Using OpenCV-Python framework, feature extraction is then performed based on the threshold suggested by the initial experimentation results. The prototype proved to be fairly quick and less obtrusive in determining if a person is intoxicated. Enhancements in both hardware and software aspects may be implemented to develop more robust intoxication detectors.

**Keywords:** Drunk Detection, Thermal/Infrared imaging, False-color, Raspberry Pi, OpenCV

## Introduction

Presently, there are two principal methods to determine if a person is intoxicated or under the influence of alcohol, namely (a) field sobriety test and (b) blood-alcohol concentration test or chemical blood test. These methods are chiefly employed by the police in road safety enforcement. In the first test, a police officer may look for extrinsic symptoms and behavioral signs of inebriation such as eye-jerking, slurred speech, inability to walk straight, etc. The second test involves sampling and analysis of a person's breath, urine or blood. Of the three, blood testing provides the most direct and reliable results [8]. Field sobriety test is a preliminary drunk detection method while chemical testing is confirmatory. Regardless, these two techniques are highly invasive and obstructive. Additionally, they are often used exclusively on the road to prevent 'driving under the influence of alcohol' (DUI); on the other hand, there are few to no intoxication detector systems for schools or facilities to prevent 'working/going to classes under the influence of alcohol.'

In this paper, we present a simple and unconventional approach to detect intoxicated individuals using thermal infrared imaging. This approach is demonstrated by building a proto - typical apparatus which can be implemented both as a fixture in facilities and as a mobile apparatus for road use. The apparatus, which is mainly comprised by a thermal camera core interfaced to a dedicated single-board computer, relies on real-time thermographic scanning on the frontal face of the person being tested. We aptly named the apparatus 'Thermoxicator' (thermo-graphic intoxication detector). The device determines if a person is intoxicated by indirectly measuring the warmth of the nose relative to other parts of the face. This is done by extracting simple false-color thermal features from specific region/s of interest (ROI).

The fundamental premise of this paper was induced by the fact that alcohol consumption causes the skin surface's temperature to rise. This is especially true for the face and certain face regions, as was demonstrated by reference no. [3]. Same reference also provided the initial backbone to this paper's hypothesis, that is, after alcohol intake, the nose region exhibits increased temperatures compared to other facial areas [3], a phenomenon that can be exploited to indicate intoxication or even sobriety.

The remainder of this paper is structured as follows. Section 2 presents the process of and considerations in designing the prototype Thermoxicator. Section 3 discusses the reliability and performance evaluation procedure of the prototype and the results thereof. Section 4

sums up findings and conclusions. Lastly, Section 5 outlines recommendations for future work.

### *Prototype Development*

The process of designing the Ther-moxicator apparatus involves the following in sequential order: setting up hardware integration and software interfacing; initial experimentation in order to determine the threshold of detection; and building the intoxication detection software algorithm.

### *Components and Interfacing*

As mentioned, the apparatus mainly consists of a thermal imager and a microcomputer. For the thermal imager, we used the FLIR Lepton module, a low-cost IR camera core. It has a microbolometer array of 60x80 pixels with 17 microns per pixel. The spectral response of the camera is 8-14 microns, which falls directly under the LWIR band. With a horizontal FOV of 51° and vertical FOV of 40°, the aspect ratio of the imager is wide enough to capture faces with reasonable quality. The module can be triggered by TTL signals to transmit word-size sensor packets to a computer. These packets can be translated into digital false-color images. This allows easy hardware and software interfacing between the Lepton module and any single-board computer via serial communication protocols such as SPI. The 32-pin FLIR Lepton module is socketed to a breakout board which can then be connected to an SPI-equipped SBC like Raspberry Pi.

As for the processing unit which will handle and evaluate the data from the Lepton module, a single-board computer that operates on low power with sufficient processing speed, memory and external hardware control capability, is preferred over a conventional computer. The Raspberry Pi 3 (model B) computer was chosen based on mentioned criteria. It is equipped with general-purpose input/output and data transfer buses including Serial Peripheral Interface (SPI) and Inter-integrated Circuit (I<sup>2</sup>C). A Debian-based, desktop oriented artificial OS specifically for the Raspberry Pi, called 'Raspbian', was loaded to the ARM-based computer. The Linux distribution comes preloaded with Python and a host of useful image processing and GPIO packages/libraries. The Raspberry Pi proved to be highly suitable for this endeavor.

In addition to the Lepton module as thermal imager, an auxiliary alcohol sensor is incorporated into the apparatus so as to supplement it with a secondary detection channel. It makes up for Ther-moxicator's possible false detections due to the rather low resolution of the Lepton imager. We use MQ3 ethanol sensor module for this purpose. It is highly

sensitive to diffused ethanol vapor, such as that found in the breath of an intoxicated person. The MQ3 module has on-board ADC circuit that allows it to transmit discrete I/O signal to the Raspberry Pi via GPIO when its on-board comparator detects a conductivity change in its sensing material (SnO<sub>2</sub>).

Indication is achieved by means of audio and visual warnings, which are triggered according to either positive (intoxicated) or negative (sober) detection made by ThermoXicator. Audio indication, in the form of artificial speech, is provided by speakers, whereas visual indications are realized by a mere pair of 3mm LEDs and GUI application widgets on Raspbian's desktop environment.

The Lepton module is interfaced with the Raspberry Pi primarily via SPI. The Lepton has built in Command/Control Interface hosted on a Two-Wire Interface (CCI/TWI) device that allows it to be controlled from the Raspberry Pi via the I<sup>2</sup>C bus. Sensor data packets from Lepton imager is sent to the Raspberry Pi via the SPI bus, while flat-field correction (FFC) control is done via I<sup>2</sup>C

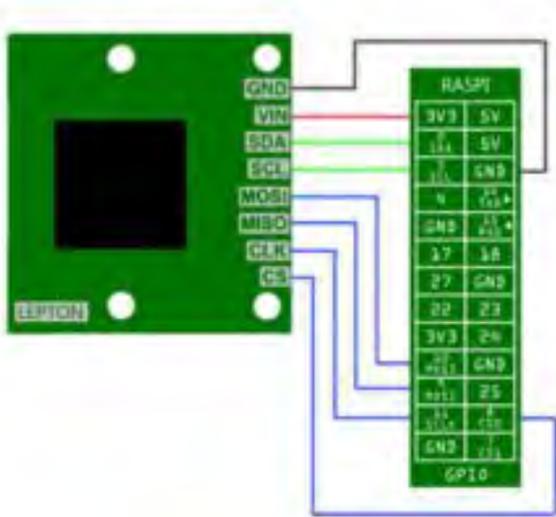


Figure 1. Lepton PCB (left) interfaced to Rpi GPIO (right)

protocol. Figure 1 shows the physical connection between Raspberry Pi's GPIO header and the Lepton breakout board to achieve SPI and I<sup>2</sup>C communication. On the Raspberry Pi's GPIO header, header pins 19 (SPI Master-Out/Slave-In), 21 (SPI Master-In/Slave-Out), 23 (Clock) and 24 (Chip Enable #0) are connected to Lepton breakout board pins 'MOSI',

'MISO', 'CLK' (clock) and 'CS' (chip select), respectively. These connections are represented as blue wires in Figure 1. Now, for FFC calibration via I<sup>2</sup>C, Raspberry Pi connects to Lepton CCI/TWI from header pins 3 (SDA or Data) and 5 (SCL or Clock) to Lepton board's 'SDA' and 'SCL' respectively. These connections are represented as green wires in Figure 1.

Having the physical channels in place allows the Lepton imager to be controlled so as to continuously transmit sensor data packets by software-automated means. To establish software interfacing between the Lepton imager and the Raspberry Pi, an open source software development kit was used. Based on this Lepton-Rpi SDK, a Qt application was built to get packets from the Lepton imager, map them into frames of hardcoded RGB colorspace and possibly stream these frames on a desktop widget in real-time. Additionally, this Qt application may have the ability to write a snapshot of the current frame into an image file and save it in the system, which aspect was particularly useful in conducting the initial experimentation. This Lepton-Rpi inter-facing program is used in two occasions: for capturing thermal images for the initial experimentation; and as part of the actual in-toxication detection software. In either case, the extent of the usefulness of the SDK is limited to the stable interfacing between the Raspberry Pi data buses and those of the Lepton imager, so that sensor data packets can be transferred at a fast rate via SPI. These packets can then be transformed into false-color thermal frames in real-time.

False-color treatment of raw sensor data involves simple linear transformation. The Lepton module has a microbolometer array of 80wx60h, hence the raw sensor data have 4,800 unsigned short words (9,600 bytes). Each word element in the raw sensor data represents a 16-bit value yielded by one of 4,800 micro-bolometers in the Lepton core. To convert this array into false-color frames, its range (*maximum - minimum value*) is mapped against a hardcoded color space array of 256 RGB vectors. Each vector (8-bit) in the color space is assigned to a set of raw sensor words (16-bit). This linear transformation creates the actual RGB thermal frames with 4,800 pixels. Because the skin surface is generally warmer than non-living objects at normal ambient temperatures, the raw values corresponding to the face are matched to non-neutral hues such as [250, 192, 20] (yellow-orangish), while values from non-human objects are matched to gray-tone values (e.g. [110, 110, 110]), producing more contrast between the face and the background. Figure 2a shows a sample thermal frame as the output of this false-color mapping scheme, while 2b shows the corresponding non-radiometric colorspace.

After false-color transformation of each thermal frame, they are rendered as 2D pixel map arrays and displayed on a desktop widget one

after another at a frame rate matching the Lepton packet rate. Thus a video stream is produced.

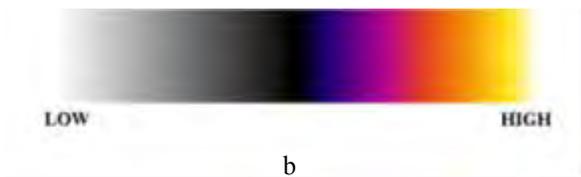
As mentioned, the Qt program operated on two purposes. The first one is to amass experimental data for determining the correct detection approach. This was done by capturing thermal images of sober and drunk test subjects, as will be discussed in the next subsection. The second role of the Qt application is to provide a real-time input pipeline to the intoxication detection software, which is coded in Python for the most part.

### *Initial Experimentation*

This phase in prototype development involves preliminary experiments whose goal was to observe and analyze first hand evidence of the effects of alcohol on facial temperature, or rather thermal features; and to determine threshold of detection in terms of false-color feature value, as well as the scanning approach to be adopted by the intoxication detection algorithm. Thus, the initial experimentation phase was accomplished by capturing and analyzing thermal images of frontal faces before and after alcohol intake.



a

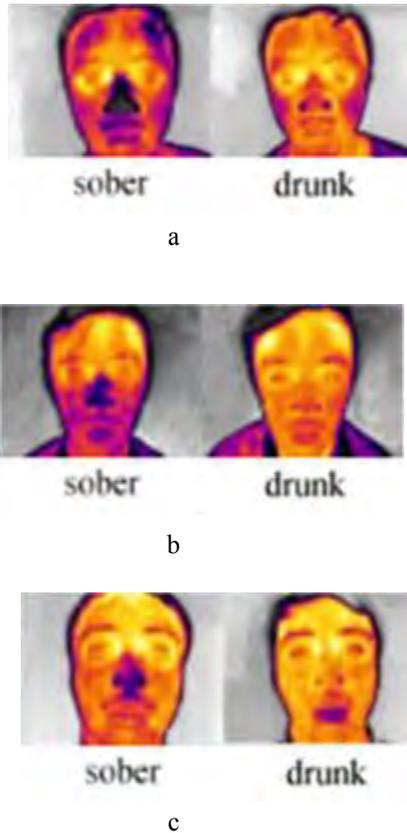


b

Figure 2. (a) Sample thermal frame; (b) corresponding ‘ironblack’ colorscale

Thermal images are captured using the hardware setup and interfacing program described in the previous subsection. We have conducted three subsequent experiments; each involved administering a certain type of liquor to 10 test subjects. The subjects were randomly selected among an indefinite population whose ages ranged from 19 to 27 years. In each experiment the controlled variable was the amount of ethanol to be administered to the participants. Any other relevant parameters and initial conditions such as illnesses, dietary preference, vital signs, gender, body weight, narcotics, etc. was not taken into account, although it was recorded that the ambient temperature during the experiments have ranged around 22 °C to 26°C.

In this paper, we define intoxication as having taken a minimum of 64 mL of ethanol within the past 2 hours. This was emulated from reference [3]. For the first experiment, beer with 6.9%-ABV was administered to the 10 test subjects, requiring them to consume at least 928 mL of the beer. For the second experiment, brandy with 22.5%-ABV was, so each subject must consume at least 285 mL of this brandy. For the third experiment, we administered gin with 40%-ABV, requiring each participant to drunk at least 160 mL. In all three experiments, at least three sets of thermal images were captured from each test subject: one before alcohol intake, another immediately after finishing off the required volume and another one 30 minutes after the consumption. Each image set is composed of five RGB thermal frames. These thermal frames served as the raw data from the initial experimentation phase. Feature data are extracted from these frames to examine the quantitative difference in facial thermal features before and after alcohol intake. Figure 3 shows sample frames from first (sober) and last (intoxicated for at least 30 minutes) image set acquisitions in each of the three experiments.



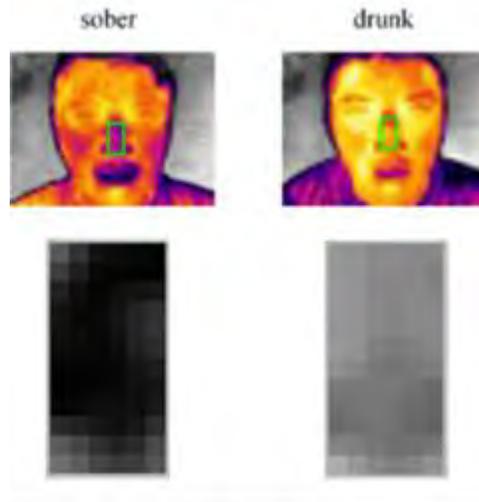
*Figure 3.* Sample thermal frames of test subjects during sober and intoxicated conditions; (a) Experiment 1, beer; (b) Experiment 2, brandy; (c) Experiment 3, gin

As the initial experimentation progressed, we have observed that thermal changes induced by intoxication occur most prominently and consistently in the nose region, as can be seen in Figure 3. There were a few instances in which quite notable changes occur in the cheek area as well. Based on this observation, we extracted feature data from the nose regions only. More importantly, this particular finding dictates that the intoxication detection algorithm needs only to focus on the nose region and the feature value thereof.

Feature data is extracted from the thermal frames using 2D array operations provided by OpenCV-Python framework. To extract feature data from the nose region, a region-of-interest is created by slicing an internal 2D array around the nose with aspect ratio 5x6. All sliced nose ROIs have 72 pixels (6x12). For the cheek feature data, the ROI has

aspect ratio of 5x4, sliced from the right cheek. The output of the nose ROI indexing procedure is shown in Figure 4.

Each frame as a whole is a 2D array with BGR triplet elements (3-channel). However, the feature values were first converted to grayscale mode before extraction. This is to increase extraction speed by reducing the array elements to 1-channel pixel intensities, as it should be in the actual into-xication detection software which will run in real-time. In quantifying the feature data



*Figure 4.* Nose feature ROI slicing and grayscale output

from either nose or cheek ROI, we adopted three feature values per image set: (1) mean pixel intensity, (2) modal pixel intensity and (3) pixel intensity variance (standard deviation). Mean and modal intensities can be used as basis for the detection threshold, whereas intensity variance only provides insight to the ROI's temperature uniformity in a specific frame. Each feature value was averaged over the five thermal frames comprised in each image set. Then, the shift in feature value of an ROI is simply the scalar difference between the feature value of an intoxicated image set and that of a sober image set.

## Threshold of Detection

Resulting feature data from the 30 test subjects reveal that the nose ROI gets warmer after alcohol consumption. Focusing on the ROI mean intensity as the primary feature value, sober and intoxicated image sets exhibit significant positive feature shifts. Generally, in terms of mean intensity, the nose ROI of an intoxicated image set has higher feature value compared to that of a sober image set.

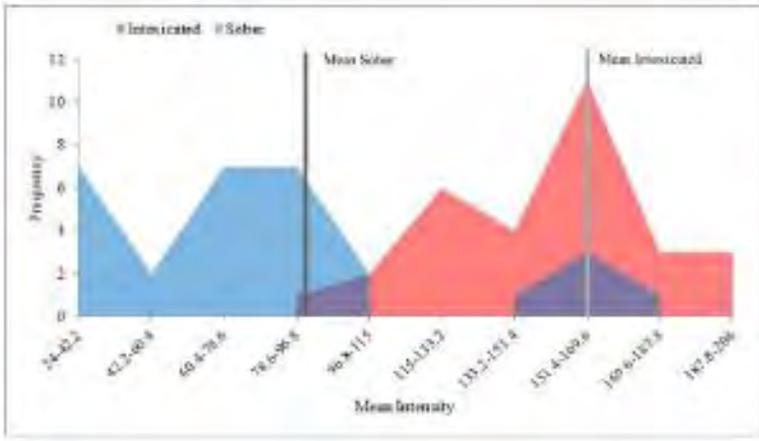


Figure 5. Histogram: mean intensities of nose feature ROIs, sober and intoxicated image sets

The feature space histogram in Figure 5 illustrates this finding. Blue area corresponds to sober feature values and red to intoxicated ones. The recorded average mean intensity for sober image sets was 82, while for drunk or intoxicated image sets the average was 152. The feature space histogram of Figure 5 further indicates that sober feature values (mean intensities), in general, are below the 115 class boundary, whereas intoxicated feature values are well above the same boundary. To be exact, 83.3% of sober image sets have nose ROI feature values below 115, while 90% of intoxicated image sets have nose ROI feature values above 115. Although few overlaps exist due to some of the 30 test subjects' unexpected thermal patterns, it can be said that sober and intoxicated feature values are separable in the feature space by a mean intensity class boundary of 115. This suggests that the intoxication detection algorithm can set the threshold of detection—in terms of ROI mean intensity—anywhere near the 115 feature value mark.

## Intoxication Detection Software Algorithm

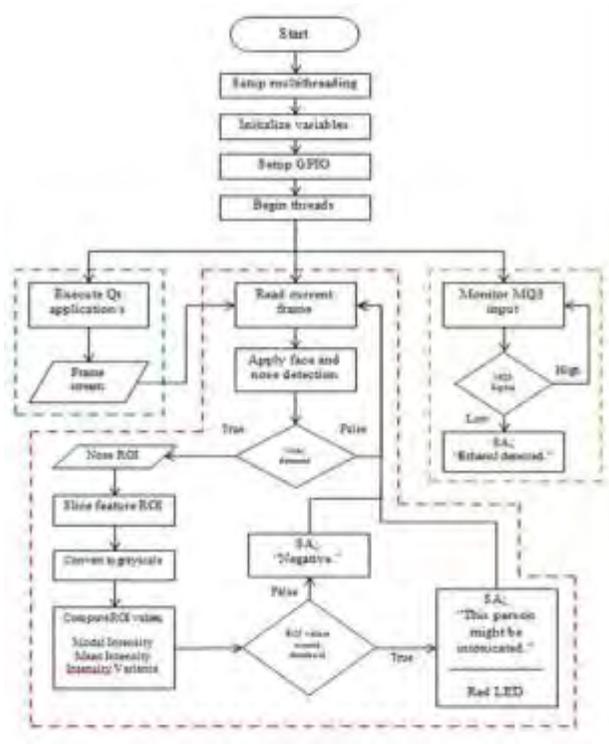


Figure 6. ThermoXicator program flowchart

The embedded ThermoXicator software adopts a simple approach in detecting intoxicated individuals based on false-color information in the thermal frontal face. If the mean pixel intensity of the nose feature ROI exceeds the threshold of detection, then the apparatus identifies the person as intoxicated. The software has two core functions: (1) thermal data processing and (2) indication hardware control, both of which are carried out in real-time. The detection software is mostly coded in Python 2.7. A Qt program that runs the Lepton-Rpi interfacing thread provides the backend service to the Python virtual machine (see latter part of Subsection 2.1). Figure 6 illustrates the software algorithm. The Python script itself runs three parallel threads. These thread functions are embodied in the enclosed subparts of the flowchart. The first thread (enclosed in blue dashed lines) simply runs the backend Qt executable which feeds the input thermal frames to the data processing thread (red dashed lines). The third thread is dedicated to the operation of the MQ3 ethanol sensor module, allowing Raspberry Pi to monitor its input signal at any point during the scanning procedure.

The main data processing thread runs a continuous while loop. The loop begins with grabbing the current thermal frame as streamed by the Qt backend. A JPG file is constantly overwritten by the Qt backend with the current frame and is regularly read by the data processing thread. Once the frame has been read as a 2D array object, the thread then proceeds with the rest of the feature extraction process.

### *Face and Nose Localization*

The first stage of feature extraction is face and nose detection. The apparatus should be able to locate first the frontal face and then the nose region before applying ROI feature extraction. This is accomplished by using OpenCV cascade classification. To achieve accurate face and nose classifier with very low false positives and false negatives, we trained a custom cascade classifier out of the thermal images we have captured during the initial experimentation phase plus others acquired along the prototype development. Positive images are provided by marking up frontal faces and noses from the thermal images, while negative images are just arbitrary frames that do not contain either a face or a nose at a close distance. The OpenCV framework provides a complete set of tools and utilities to build a custom classifier data. Local binary patterns are applied on the classifier training. The final cascade classifier database is generated as an XML file.

To detect face or nose in any thermal frame, the classifier data is loaded in the Python script by creating a *cv2.CascadeClassifier(classifier)* object that reads the XML file. The next step is to invoke the classifier object's *detectMultiScale(array)* method which will ultimately localize the face in a thermal frame and the nose within the face. The function returns the dimensions—upper right vertex (x, y), width and height—of the rectangular demarcation of the 2D array that contains the detected face or nose. Frontal faces and noses are detected at a rate in the order of a few milliseconds. Figure 7 shows the output of the face/nose localization process.

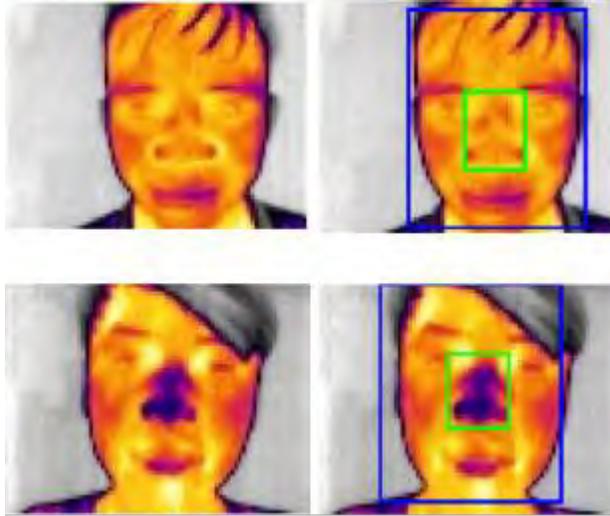


Figure 7. Face and nose detection using OpenCV cascade classifier

### Feature Evaluation

After nose detection, the next step is evaluation of feature value in the nose feature ROI. If a nose is detected in the current frame, only then will the thread proceed to index the feature ROI; otherwise the Thermoxicator will just continue to look for frontal face and a nose in the incoming frames. The nose feature ROI is sliced within the one whose dimensions are returned by the *detectMultiScale(array)* method. The feature ROI is a smaller 2D array within the nose ROI itself (bound by green rectangles in Figure 5) and it is where feature evaluation is performed. Figure 4 sets an example of the nose feature ROI. In Python, the slicing format is *mat[y1:y2,x1:x2]*, where *(x1,y1)* and *(x2,y2)* represent the upper right and lower left indices of the sliced 2D array, respectively. Since the nose ROIs always have coherent dimensions and constant aspect ratio, the desired position of the feature ROI relative to the nose ROI is hardcoded. Next, the feature ROI is converted from BGR to grayscale format using *cv2.cvtColor(src, code)*. This is then followed by the computation of feature values in the feature ROI. Mean intensity and intensity variance are obtained by the *cv2.meanStdDev(array)* method which returns a tuple of the mean pixel value and standard deviation of the pixel intensities in the feature ROI. Modal intensity is obtained using *scipy.stats.mode(array)* method.

The resultant feature value is then compared to the threshold mean intensity of 115. This polling mechanism ultimately indicates whether the person is sober or intoxicated and triggers the indicator

system accordingly. If the resultant mean intensity is higher than 115, then the scanned person is identified by Thermoxicator as intoxicated. Otherwise the person is regarded as sober. After activating the appropriate indicators, i.e. artificial speech and either of two LED bulbs, the thread starts over again at the top of the loop. The entire feature extraction process is reiterated continuously in real time.

### *Prototype Evaluation*

The operation of the developed apparatus is evaluated primarily in terms of the accuracy of its detection, or how reliable it is in indicating intoxication based on persons' faces. Secondly, the speed at which the apparatus determines the alcoholic state of a person is measured.

### *Reliability*

To weigh its potential of being implemented as an actual facility- or road-based intoxication scanner, we tested the prototype's accuracy in determining if a person is indeed intoxicated. Note that only the thermographic channel (Lepton imager) and the data processing thread were tested in this procedure, while the ethanol sensor (MQ3 module) was not.

In the reliability test, the criterion was simple: the Thermoxicator must correctly indicate whether a person is sober or intoxicated. To test the detection reliability of the Thermoxicator, we used it on 10 test subjects before and after administering 160 mL of 40%-ABV gin to each of them. As with the initial experimentation, any other relevant parameters and initial conditions aside from ethanol dosage per test subject, was not considered. Before alcohol intake, each person was scanned for five times using the Thermoxicator. Resulting indications according to the apparatus were recorded. We then administered liquor to half of the test subjects and leave the other half sober. After a 30-minute supervised standby, each person was scanned again for five times. Thermoxicator's indications were recorded again. For each test subject, therefore, the testing procedure yielded 10 detection results which could be either 'correct' or 'incorrect'. With 10 test subjects, there were a total of 100 detection attempts. The elevation of the Lepton module was manually adjusted so that it matches the person's height.

### *Scanning Rate*

The scanning rate is measured by recording the thread execution speed or how fast the program is executed. The speed of program execution is measured by embedding a timer in the Python main data processing thread. A *time.time(s)* object is called, one before the firstline

of feature extraction process and another next to the last line of the entire data processing thread. The difference between the two timer objects is the total elapsed time the thread function has taken to execute feature extraction. It is recorded alongside each of the 100-trial reliability results.

### Testing Result

Tables 1 and 2 present the results both from reliability testing and scan rate testing. Intuitively, reliability testing results are either an ‘S’ (for sober indication) and ‘I’ (intoxicated) mark. In the tables, scan speed test results are labeled as ‘p.e.d.’ for ‘program execution du-ration’. It is represented in terms of milliseconds. Table 1 tabulates the results from first batch of trials which is before administering liquor to the test subjects. Table 2 presents the results from second batch of trials which are after liquor consumption.

Table 1

*1<sup>st</sup> Batch, expected indications are sober for TS 1-10*

trial	Test subject no. 1		Test subject no. 2		Test subject no. 3		Test subject no. 4		Test subject no. 5	
	result	p.e.d.								
1	S	45	S	23	S	89	S	39	S	78
2	S	132	S	17	S	250	S	44	S	203
3	S	67	S	140	S	195	S	107	S	315
4	S	340	S	178	S	419	S	340	I	365
5	S	980	S	364	S	524	S	1,043	I	547
	6		7		8		9		10	
1	S	105	S	68	S	132	S	31	I	130
2	S	160	S	243	S	266	I	138	I	33
3	S	656	S	519	S	634	S	584	I	530
4	S	836	S	979	S	989	S	776	I	891
5	S	806	S	838	S	955	S	2,134	S	962

Table 2

*2<sup>nd</sup> Batch, expected indications are sober for TS 1-5 and intoxicated for TS 6-10*

trial	Test subject no. 1		Test subject no. 2		Test subject no. 3		Test subject no. 4		Test subject no. 5	
	result	p.e.d.								
1	S	384	S	42	S	75	S	12	I	92
2	S	237	S	115	S	130	S	95	S	140
3	S	93	S	121	S	312	S	107	S	76
4	S	605	S	99	S	870	S	780	S	514
5	S	758	S	708	S	524	S	896	S	547
	6		7		8		9		10	
1	I	200	I	262	I	157	I	234	I	213
2	I	144	I	234	I	199	I	227	S	30
3	I	682	I	646	I	539	I	582	I	538
4	I	730	I	713	I	852	I	813	I	928
5	I	961	I	1168	I	830	I	978	I	994

Shaded cells in each table indicate false detection. The first batch of trials yielded 43 correct detections out of 50 trials. The second batch yielded 48 correct detections out of 50 trials. Overall, the apparatus was able to correctly detect either soberness or intoxication in 91 out of 100 test subjects.

Resulting program execution durations show that the apparatus, upon localizing the nose feature ROI, was able to quickly determine soberness or intoxication. For 97% of the total attempts, the duration was under 1 second. The longest recorded p.e.d was 2.134 seconds, while the shortest was 0.012 seconds. The average p.e.d. throughout the testing procedure is 435 milliseconds

In the evaluation of the Thermoxicator's speed and performance, the apparatus attained 91% detection reliability rating and an average scanning time that is well below 2 seconds.

## **Conclusions**

In this paper, a simple approach using false-color thermal imaging was presented as an alternative means to suggest if a person is drunk or intoxicated. Using lightweight platform and components, the thermographic intoxication detector apparatus was realized. The hardware and software components of the system proved to be suitable in this pursuit.

The initial experimentation phase of prototype development revealed that alcohol consumption indeed causes the temperature of the skin surface, at least on the face, to increase in general. Specifically, the most prominent thermal changes in the face occur in the nose region. This phenomenon was exploited effectively by the Thermoxicator to distinguish an intoxicated individual from a sober one.

Results from the Thermoxicator's final evaluation indicate that, under strictly controlled environmental and variable setting, the apparatus can detect an intoxicated person with great reliability and speed. There have been a few false detections that may be attributed to the feature overlaps in Figure 5. Furthermore, it shows that the Thermoxicator can localize face and nose regions quite accurately, with few false positives and negative localizations. The scanning procedure introduced by the apparatus is significantly less obtrusive and invasive than existing intoxication detection means or devices.

## **Recommendations**

Potential improvements to this work diverge to at least three relevant fields: Electronics/DSP, Computer Science and Medicine/Physiology.

The use of higher end embedded computer and thermal imager in place of or in conjunction with the Raspberry Pi 3 and FLIR Lepton is highly encouraged, although such an upgrade, especially on the thermal imager, implies greater financial costs. Moreover, the Raspberry Pi is meant for general IoT applications. Opting for more specialized embedded computers that are designed for real-time applications should produce better-performing systems. Also, the vertical placement of the thermal imager is a particular aspect that necessitates automation. If feasible, future improvements could include automated adjustment of the camera's positioning and orientation by using servo systems or linear actuators.

Development of better graphical interface as part of the apparatus's indication system is highly recommended for future attempts of augmenting the software features of the Thermoxicator. Additionally, more effective localization and feature extraction algorithms may be developed in order to improve the efficiency of the intoxication detection software. For starters, piping sensor data directly from a Python framework instead of utilizing the manufacturer-developed Lepton SDK could be a simple and neat modification.

There are not many studies that investigate the phenomenon of alcohol effect on facial skin temperature. While this paper reproduces the findings of a relevant pioneering study on this phenomenon, the dimensionality of the experiments herein was heavily diminished to such extent that the study was simplified and focused on prototype development. We recommend that more in-depth research and experimentation be conducted to further explore how the person's nose and the rest of the face thermally behave as the person consumes alcohol. Outputs of such endeavors may lead to more robust thermographic detection approaches.

## **Acknowledgements**

This work would not have materialized if not for the open source FLIR Lepton software interfacing SDK provided by Pure Engineering.

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# **Assessment on the implementation of TB dots program in selected barangays of Bacoor, Cavite**

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## **Abstract**

Tuberculosis or TB is an infectious disease caused by the bacteria called *Mycobacterium tuberculosis* that can be transferred by droplets. Lungs are commonly this disease. It is curable and preventable. This study focuses on the assessment of the implementation of TB DOTS program in selected barangay of Bacoor, Cavite in terms of case finding, case holding, recording and reporting and prevention of TB. The respondents of the study were the 70 adult TB patients currently enrolled in the said program. The researchers used a descriptive quantitative type of research to determine, analyze and interpret the data gathered. Majority of the respondents has no family history of tuberculosis, smoking and consumed 10 or more cigarettes a day, belongs to an extended type of family lives in a wooden type of house with not enough ventilation. The respondents perceived always in case finding, case holding, recording and reporting and prevention of TB which mean that the TB DOTS program is well implemented by the health workers. The demographic data of the respondents has significant relationship with the implementation of TB DOTS program.

**Keywords:** Tuberculosis, TB DOTS, implementation

## Introduction

“Unite to end TB, together we will make it happen.” – WHO

Tuberculosis or TB is an infectious disease caused by the bacteria called *Mycobacterium tuberculosis*. It is transmitted from a TB patient to another person through coughing, sneezing and spitting. Thus, close contacts, especially the household members, could be infected with TB. Lungs are commonly affected but it could also affect other organs such as the kidney, bones, liver and others. TB is curable and preventable. However, incomplete or irregular treatment may lead to drug-resistant TB or even death (MOP, 2014).

Moreover, the World Health Organization described TB is an infectious disease killer worldwide that usually affects the lungs. It is the second greatest killer due to a single infectious agent worldwide, and in 2014, 9.6 million people fell ill with TB and 1.5 million died from the disease. Over 95% of TB deaths occur in low- and middle-income countries, and it is among the top 5 causes of death for women aged 15 to 44. In 2014, an estimated 1 million children became ill with TB and 140 000 children died of TB. TB is also the leading killer of HIV-positive people: in 2015, 1 in 3 HIV deaths was due to TB. Globally in 2014, an estimated 480,000 people developed multidrug-resistant TB (WHO, 2015). While the Philippines ranks as one of the global top 10 in TB prevalence. The rate of new infections, despite a push from the Millennium Development Goals has not fallen in the country in the last 15 years – stubbornly sitting at 290,000 new infections each year (World Vision, 2015).

## Methodology

The researchers used descriptive quantitative type of research method which is a type of method where the researcher limits the possible ways in which a researcher participant can react and express appropriate social behavior. It provides the number of time something occurs of frequency and itself to statically calculations such as determining the average number of occurrences (Key, 2013) and method that provides data about the population that will be study; and will allow the researcher to examine the characteristic, and experience of study participants (Polit,2014).

### *Population Locale*

This study was conducted in Barangay Zapote 5, Zapote 2, Talaba 1,3,4, Salinas 1, Real 1, Niog 1,2,3, Panapaan 4 City of Bacoor, Cavite. These barangays have the most TB cases in the city.

### *Research Instrument*

The researcher used self made type of questionnaire that is based on the Manual of Procedure, as the main tool for gathering the data the questionnaire consists of the implementation program to the NTP MOP of health staffs of the City Health Office of Bacoor.

The questionnaire was divided into two parts:

Part 1 was composed of the demographic data of the respondents. It consists of the family structure, history of tuberculosis in the family, lifestyle, environment and it is in checklist form.

Part 2 was composed of the implementation of TB DOTS program to the NTP MOP of health staff of the City Health Office of Bacoor.

It consists of questions that are related to the following variables: a.) case finding b.) case holding c.) prevention of Tuberculosis d.) recording and reporting

### *Data Gathering Procedure*

The data gathering procedure is divided into 2 phases:

Phase 1 – Preparation. The researchers composed a letter of intent and present it to the adviser for its approval. Upon approval of the letter, it is sent to the City Health Officer of the City of Bacoor for the researchers' approval to conduct the data gathering process. Also, consent is asked from the respondents to gather the data.

Phase 2. Survey and Data Gathering. During the weekdays of the Month of March, the researchers conducted the survey and the data gathering procedure. The questionnaire is used and given to the respondents. After the respondents answered of the questionnaire, the researchers collect and check if it is answered completely and consolidated the answers for the data analysis and interpretation of the result of the study.

## *Data Analysis*

The following are the statistical tools used to answer the specific problems and hypothesis of the study.:

**Mean.** This is the point on the scale that is equal to the sum of all scores divided by the total number of the scores. In this study the mean will use to determine the level of compliance of the selected health personnels to the New National Tuberculosis Program Manual of Procedures. Scales will be use in this statistical computation based on Polit and Hungler (1999), the formula in getting the mean is:

$$X = \sum x / N$$

Where:

X = stands for mean

$\sum$  = the Greek letter sigma; the sum of

X = stands for the individual scores

N = stands for the total number of score

E mean is the index of central tendency that is usually referred to as an average by an X bar.

**Frequency Distribution** – are used to organize numeric data systematically from lowest to highest, together with a count of the number of times each value is obtained. It is consisting of 2 parts:

- a.) Observed values
- b.) Frequency of cases

**Percentage** - This will cover the demographic data of the respondents. Percentages were used to express how large one quantity is relative to another quantity. (Shapiro, 2008). The formula for the computation of percentage distribution is:

Where:

% = percentage

f= frequency

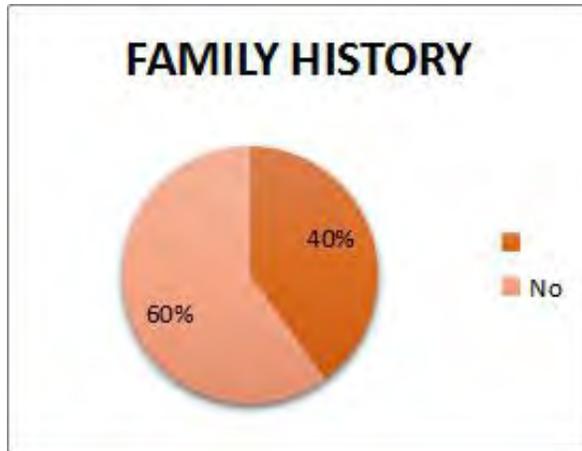
N= total number of respondents

**Spearman rho** - is the correlational procedure commonly used with ordinal data.

## *Validation and Reliability Testing*

The questionnaire used by the researchers underwent a validation process and reality test it was checked by the research adviser as well as 4 experts including Medical Officer, Nurse Supervisor, TB DOTS Coordinator, and Research Experts. The questionnaire also underwent a Pilot Test, twenty respondents were asked to answer the questionnaire.

## Results and Discussion



*Figure 1.* Frequency and Distribution of Respondents According to Family History

From the above figure, it can be seen that the Majority of the respondents or 60% has no history of tuberculosis in the family. The researchers assume that family history has a big role in tuberculosis transmission since it is airborne, If a family member has whether a known or unknown case of tuberculosis it can be easily transmitted within the family members especially those who are risk of having tuberculosis such as immuno compromised, diabetic patients and PLHIV or people living with HIV.

In relation to this, family history of TB is important when assessing the risk of TB or of diagnosing the disease. In some countries it is believed that TB was a hereditary disease due to several members of the same family being diagnosed within a short period of time (Davies et al.,2015) In addition, Roos and Tunkel (2010) discussed that obtaining from the family a history for possible exposure to tuberculosis is important, but this history can be unrevealing.

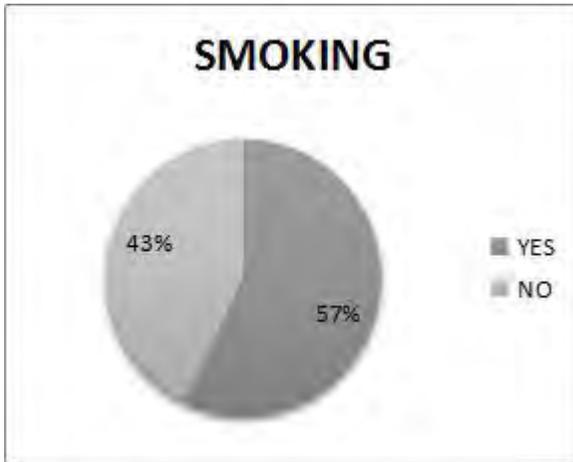


Figure 2. Frequency and Distribution of the respondents According to their Lifestyle

Figure 2 shows that forty (40) or fifty-seven (57) percent answered yes, they are smoking and thirty (30) or forty-three (43) percent answered no.

The above figure shows that majority of the respondent or 57% is smoking. The researcher presumes that smoking can weaken the lungs which can lead to lung diseases such as tuberculosis. In the study of [Mathai](#) (2013) showed that the relative risk of TB disease has a great number among smokers compared to non-smokers and that there was clear evidence that smoking effects remained a risk factor for tuberculosis infection and disease, as well as additional risk of death in persons with active tuberculosis.

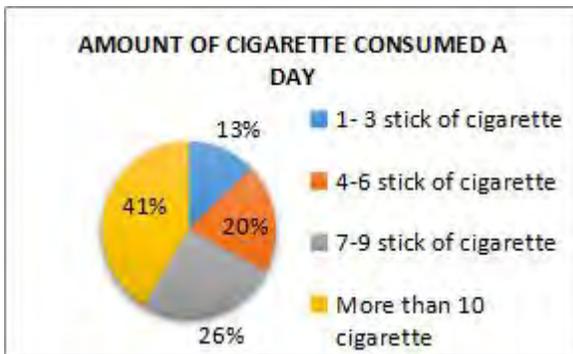


Figure 3. Frequency and Distribution of the Respondents according to their Lifestyle

Figure 3 shows that twenty-nine (29) or forty-one (41) consumes more than ten cigarettes a day. Followed by eighteen (18) or twenty-six (26) percent consumes 7-9 stick per day, followed by fourteen (14) or twenty (20) percent consume 4-6 cigarette per day and nine (9) or thirteen (13) percent consume 1-3 sticks a day.

The above table shows that most or 41% of the respondents consumes more than ten cigarettes per day. In a study conducted Hurd&Khael et.al(2013) in Cambodia, manufactured cigarette smoking was associated with lifetime TB infection and the association was most evident among the heaviest smokers (> 1 pack per day, > 30 pack years). In addition, Safa&Sharifi (2011) Considering the prevalence of smoking in TB patients, evaluation of tobacco smoking status in such patients and motivating them to quit smoking could be considered as important steps in their treatment process.

### FAMILY STRUCTURE

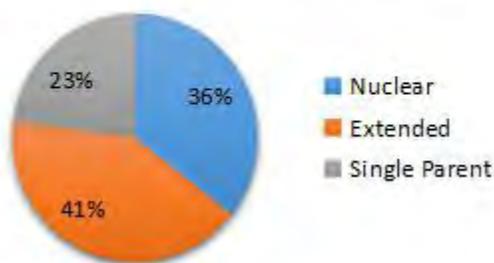


Figure 4. Frequency and Distribution of the Respondents according to their Family Structure

Figure 4 shows that most of the families or twenty-nine (29) or forty-one (41) percent belongs to extended family, twenty-five (25) or thirty six (36) percent are nuclear family and sixteen (16) or twenty-three (23) percent are single parent.

Most of the respondents or 41% has extended type of family or a family living with the relatives, the researchers assumed that type of family is a risk for PTB because of the close contact to a diagnose or undiagnosed case of Tuberculosis.

In a study by Tidy (2014) Household members and close regular contacts of a person with active tuberculosis (TB) may be advised to have tests. Close regular contacts may include colleagues, friends or classmates, depending on the situation and on how infectious TB is.

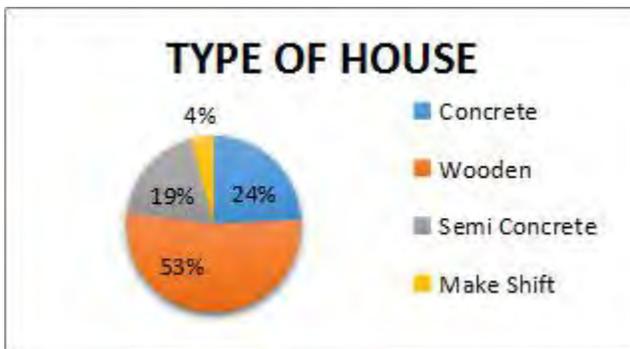


Figure 6. Frequency and Distribution of the Respondents according to their type of house.

Figure 6 shows that majority of the respondents or thirty seven (37) or fifty three (53) percent are living in a wooden type of house, seventeen (17) or twenty four (24) percent has concrete house, thirteen (13) or nineteen (19) percent has semi concrete and three(3) or four (4) percent are living in a makeshift house.

The above figure shows that majority of the respondents or 53% is living in a wooden type of house.

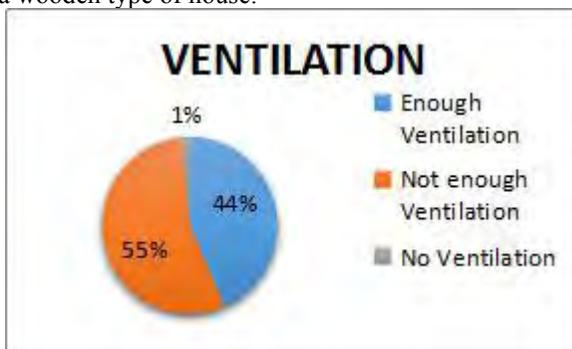


Figure 5. Frequency and Distribution of the Respondents according to their house Ventilation.

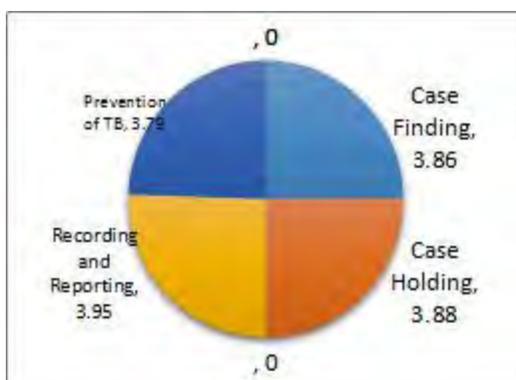
Figure 5 shows that majority of the respondents fifty-four-point twenty nine percent (54.29) percent has not enough ventilation, thirty (30) or forty-four points twenty-nine (44.29) percent has enough ventilation and 1 one or one point forty-two (1.42) percent has no ventilation.

The above figure shows that majority of the respondents or 54% has not enough ventilation in their houses. Thus, the researchers assumes that not enough ventilation can be a factor in the transmission of the TB

bacteria. In addition to this, Mathai (2013) revealed that the tuberculosis burden relates a strong socioeconomic status between and within countries with the poorest having the highest risk people with lower socio economic status have a higher likelihood of being exposed to crowded, less ventilated places.

Moreover, Mandalakas et al. (2013) studied regarding the household studies and it includes a great size in epidemiologic data about environmental risk factors for transmission of disease within homes. Tuberculosis involves factors like ventilation and crowding within homes that increases the degree of contact.

## **PART II. Implementation of DOTS Program in terms of Case Finding, Case Holding, Recording and Reporting & Prevention on TB**



*Figure 7. Implementation of TB dots program in Barangay*

Figure 7 shows that in case finding with a general weighted mean of 3.86, case holding with general weighted mean of 3.88, recording and reporting and prevention of TB with a general weighted mean of 3.79 interpreted as always shows that the program in terms of case finding, case holding, recording and reporting and prevention of TB is well implemented by the health workers of Bacoor, Cavite.

The study revealed that the health workers of Bacoor, Cavite has good implementation of the TB DOTS Program.

The researchers assume that well implementation of TB and giving quality health services can help the patient help patient throughout the course of the treatment.

In relation to this, DOH-Washington State (2012) stated that a health worker has an important part of helping patients take their medicine is educating them about TB. This means talking to them about the cause of TB, the way TB is spread, how TB is diagnosed, and their specific treatment plan. Patients cannot be expected to adhere to treatment recommendations if they are not educated about TB and how it is treated, and patients who understand these concepts are more likely to adhere to treatment. Patients need to understand that they are infected with TB, that they may have specific risks for progressing to TB disease, and that they can take precautions to protect themselves, their family, and their friends. Patients with TB disease need to understand the seriousness of the disease and why it is important to adhere to treatment. In order to prevent relapse and drug resistance, clinicians must prescribe an adequate regimen and make sure that patients adhere to treatment. To ensure completion of treatment, the public health department should thoroughly educate the patient, monitor the patient’s adherence, and use incentives and enablers.

**PART III. Significant Relationship of Demographic profile of respondents and Implementation of TB DOTS program**

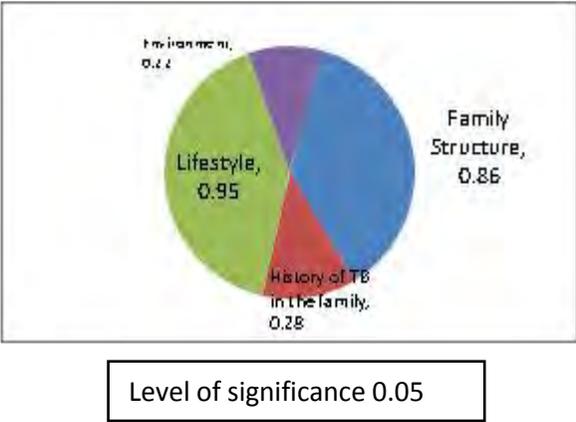


Figure 8. The relationship of profile and implementation of TB dots program

Figure 8 shows that the demographic data of the respondents has significant relationship to implementation of health workers to the TB DOTS program.

The researchers believe that family structure, history of TB in the family, lifestyle and environment is significantly related to the implementation of TB DOTS program. In a way that family structure and history of TB in the family can be a part of spreading the bacteria if a family member is presently diagnosed or undiagnosed with Tuberculosis that is spread through droplet infection. Lifestyle such as smoking can trigger in weakening the lungs which may lead to tuberculosis. Also, Environment can be a source of tuberculosis due to lack of ventilation, whereas the bacteria and viruses can live and when an immunocompromised person is living in an area which lacks ventilation he or she can easily acquire communicable diseases such as Tuberculosis.

In relation, the study of Freitas I.M et.al (2012) supports that demographic profile such as family structures is associated to the development of tuberculosis. Furthermore, Hill P. et.al (2016) showed a significant increased risk household crowding and history of household exposure to a known TB case.

## **Findings**

Here are the different findings of this study:

1. The researchers found out that 60% of the respondents has no history of TB in the family, 40% are smoking prior to treatment and 41% consumes more than 10 sticks per day, 41% belongs to extended type of family and 53% lives in a wooden house, 54% has not enough ventilation in their houses.
2. Based on the questionnaire the respondent perceived always in terms of case holding, case finding, recording and reporting and prevention and control.
3. Family structure, history of tuberculosis in the family, lifestyle and environment is significant.

## **Conclusion**

Based on the findings of the study, the following conclusion are made:

1. Most of the TB patients in our study has no history of tuberculosis in the family, smoking, consumes 10 sticks and above per day, belongs to an extended type of family, lives in a wooden type of house with not enough ventilation

2. The respondents perceived always in case finding case holding, recording and reporting and prevention of TB with means the TB DOTS Program is well implemented.
3. The demographic data of the respondents has a significant relationship with the implementation of the TB DOTS program in terms of case finding, case holding, recording and reporting and prevention of TB.

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# Rock Steady: Rock balancing as a stress-reduction strategy among student-leaders of the School of Arts and Sciences in Emilio Aguinaldo College-Cavite

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## Abstract

Rock balancing as a form of art was also believed to be an “art with a purpose”. This was used as a relaxing activity by others, helping individuals to meditate using rocks that is known to be thrown. In this study the following queries were used to help in demonstrating the relevance of the study: (a) *Knowing the profile of the participants;* (b) *Determining the stress level of the participants before and after the activity;* (c) *Knowing the significant difference between the pre-test and post-test of the participants and;* (d) *Determining perceived effects of the activity according to the participants.* Rock balancing has no effect to the stress level of the participants served as the null hypothesis of the study. This study aimed to benefit the following group of people: (a) *Student-leaders,* (b) *School Administration,* (c) *Professional Practitioners and;* (d) *Future researchers.* The study excluded other student organizations, other types of stress, academic performance and positions of student leaders and foreign students. Experimental and within-subject design were used in the study carrying-out a 24-session activity followed by a feedback gathering procedure. In this study, purposive sampling was used in screening the participants. Findings showed that post-test resulted a lower stress level to most of the participants and was effective in reducing cognitive and psychosocial stress. The perceived effects of the activity were developed concentration, temporary reduction of stress and was perceived as a fun activity. This study recommended rock balancing as a strategy for stress reduction. Furthermore, future researchers of the similar study were recommended to develop the said activity by increasing the number of participants and allot longer sessions to see further effect.

**Keywords:** Experimental Psychology, Student Leaders, Stress Level, Rock Balancing, Purposive Sampling

## Introduction

Stress is defined by Lazarus and Folkman as an individual response against the threatening environment and against his or her abilities, sources and health (Mahmoodabad, et. al. 2014). According to Anisman (2014) stress, as coined by Hans Selye in 1936, is the non-specific response of the body to any demand for change. Selye had redefined it as the rate of wear and tear of the body.

Normally, people use the term stress to describe how they are psychologically affected by the things around them (stressors). Stressors are defined as events that are appraised or perceived as aversive which cause the stress response (Anisman, 2014). Simply put, stress is a product of individual and its stressor. People use the term stress to explain how they are currently responding to the situation they are experiencing. But, stress is not just the term that would actually fit on individual's reaction. There are such aspects like the stress level, stress management and coping strategies, which aid in categorizing one's stress experience towards deeper understanding of the response.

Leadership is the act of motivating a group of people to act towards achieving a common goal (Ward, 2009). Leadership plays a vital role in a group which then ignites the interest and the fire within each member to move towards group objective. It is a process by which a person influences others to accomplish an objective and directs the organization in a way that it makes it more cohesive and coherent (Boulding, 2008). According to Martinez, as cited by Vibora (2009), this process is both direct and indirect interaction among each part of the group. Leadership transforms potential into reality. It transforms the potential ideas into kinetic concept. It makes a notion a working notion that is slowly ascending in reaching the common goal of the group or organization.

Student-leaders play a vital role in running the student affairs. Initially, these student-leaders of organizations were elected by the members of the group. Student-leaders were elected because they were being believed to possess excellent academic performance, eloquence in speeches, high intelligence quotient and popularity (Dimalanta, 2009) with which is the old concept of student leaders (Chapman, Worsnip & Dyck, 2006). Student-leaders nowadays were proven to have the best managerial skills (Almerol, 2008) in handling their academic, work and personal responsibilities to be able to represent their fellow students' views, ideas and concerns to university administrators with their best abilities. They can ignite the passion of the students for better involvement and participation in any collaborative work (Dimalanta, 2009). Or in the other way around, put the organization into its deepest

place. Student-leaders have the authority to govern an organization (Sanchez, 2002) but an organization is non-existent without its members. To be able to attain effective organization, every member of the organization must be continuously trained and retrained to ensure that members could carry out the responsibilities given to one each of them (San Juan, 2001 as cited by Sy, 2007).

Coping strategies, appraisals and stress are in circular path benefiting and influencing one another. Appraisal is the evaluations that individuals make in response to potential stressor. On the other hand, coping strategies are the activities held to seek and apply solutions to stressful situations or problems that emerge because of stressors (Sincero, 2012).

One of the categories under the coping strategies is the emotion-focused strategy. This strategy uses active behaviors to distract oneself from ongoing problems or to alter one's emotions to eliminate or tolerate stress. Emotion-focused coping strategy is a technique wherein one is trying to reduce the negative emotional response associated with stress such as embarrassment, fear, anxiety, depression, excitement and frustration (McLeod, 2015). Despite of this, emotion-focused strategy is not the final answer to all of the students' stress, thus it can be used as a strategy to get into a better frame of mind before working on problem-focused techniques (Galor, 2012).

Rock Balancing, also known as Stone Stacking, is a growing activity nowadays which originally comes from the concept of cairn, of North America.

Cairn is referred to as "prayer stone stacks" (Martin, 2015). In Canada, cairn is also called as Inuksuk which serves as a landmark on various places. It was used as a look out on people's animals and forests while the owners are away. Also, it was used as landmark and is often built for long-term purposes. It is the reason why cairn is often related to rock balancing.

Rock balancing, on the other hand, is a form of art outlet in which the artist stacks stones one by one, playing with the gravity, to create various sculptures and designs. The process is said to be meditative in nature, giving the artist a sense of calm and inner balance. According to Grab (2013), rock balancing is a fairly involved meditative practice, which seems to reveal very personal and sometimes profound insights to the seasoned practitioner.

During the practice of balancing the stones, the mind is required to focus and become very quiet. The balance calls for three contact points

that can often be intuitively felt only in deep stillness and silence. (Avery, 2016). Artists who do the rock balancing needs to find the point in every stone to be stacked wherein the contact will be placed.

Most of the recent studies were focused on the stress level, the coping strategy or student-leaders alone. With this study, the researchers will be able to know the participants' stress level and at the same time, the effectiveness of coping strategy used to comply with the stress.

This study focused on the stress level and the implementation of Rock Balancing as stress-reduction activity of student-leaders in Emilio Aguinaldo College - Cavite. In this study, the researchers was under the inquiry about the level of stress of the student- leaders of the participating college and their involvement with the proposed intervention. Campus student-leaders must be pushed to the limits to achieve excellence in terms of moral, spiritual, political, social and economic outputs (Buraga, 2004) that makes sense of having such stress to the people involved. It is said by Sy (2007) that student-leaders undertake varied tasks around their school works, organization responsibilities and personal matters that is being looked up as a model by other students.

The goal of this study is to determine the effects of Rock Balancing to the level of stress of the student-leaders, and to determine whether the intervention applied is effective enough to minimize their current levels of stress.

## **Statement of the Problem**

The research problem defines the specific goals of the study and what the researchers wanted to achieve after the experiment or research. The researchers aim in determining the following inquiries along the study:

1. What was the profile of the student-leaders of the School of Arts and Sciences in Emilio Aguinaldo College - Cavite in terms of: (a.) Age; (b.) Gender; (c.) School Organization; and (d.) Year level?

2. What was the level of stress of the participants before and after the activity?

3. Was there a significant difference between the pre and post stress test among the participants in terms of: (a.) Physical Stress; (b.) Cognitive Stress; and (c.) Psychosocial Stress

4. What were the effects of rock balancing as stress-reduction strategy as perceived by the participants?

### **Hypothesis**

• Ho: Rock Balancing has no effect to the physical, cognitive and psychosocial stress level of the participants.

### **Significance of the Study**

The significance of the study is the part wherein certain individuals or groups are identified as they are expected to benefit from the study. This study is expected to be beneficial to the following group:

1. Respondents/Student Leaders—this study will help them to have a broader knowledge about the stress level that they are encountering and apply certain strategy such as Rock Balancing used within the study in eliminating or at least, minimizing their stress level. This study will also be beneficial to other student-leaders that were not chosen for the study who are also experiencing stress in handling academic, work and personal responsibilities. This study can help them to acquire knowledge in managing stress while sharing the applied strategy or other recommending short-span stress-reduction strategies.

2. School Administration—this study will provide information to the school administration of the selected school organization regarding the stress level that their student leaders are experiencing. The result of the study will give the school administration various ways to relieve or minimize the stress level not only to their student leaders, but also to the student athletes. This study can also provide information to the students' parents in which they can suggest rock balancing or other alternative stress reducing activities to their children and other family members.

3. Professional Practitioners – this study will be helpful to the therapists in addressing stress in which the therapists may suggest this activity to the clients. With the use of this activity, the therapists may have the options whether to induce short-term activities that will help the clients under stress which can be done at home, at work, or beyond the therapy venue. One clear therapy that is near to this study is the Emotion-Focused Therapy. Through this study, the Emotion-Focused Therapy can be further developed. This study will benefit the professional practitioners in the following fields of Psychology such as Clinical Psychology, Counselling Psychology and Experimental Psychology, in

which this study can also be helpful in developing therapies that can be introduced and applied to their clients

4. Future Researchers—this study will serve as a reference for the researchers who will conduct the same or related study. It will also serve as a basis for the Experimental Psychology students in conducting critical and meticulous experimental research in the future.

## **Scope and Delimitation**

The study focused on the effect of Rock Balancing activity in reducing the stress level of the student leaders, which involved the student-leaders of the School of Arts and Sciences in Emilio Aguinaldo College – Cavite, namely School of Arts and Sciences Student Council, Communication Society and Psychology Society.

The study excluded other student organizations, other types of stress, academic performance and positions of student leaders and foreign students.

The researchers measured the respondent's stress level in three areas, physical, cognitive and psychosocial.

The involved school organizations were said to be performed by the Arts and Sciences Department focusing only with a small number of population. Since it was the first attempt of the experiment, the researchers wanted to test the study within their own department to perform the study with their utmost caution.

## **Theoretical Background**

Richard Lazarus and Folkman's Theory of Cognitive Appraisal strongly supported the study. The theory included Coping Strategies such as appraisal-focused strategy, problem-focused strategy and emotion-focused strategy. In this study, the emotion-focused strategy was used which supported, also, the entire work.

Coping is an activity done to seek and apply solutions to stressful situations or problems that emerge because of stressors. This is also a response to stressor. With this type of coping strategy, which is the emotion-focused strategy, this served as a way wherein an alteration of one's emotions was done to tolerate or eliminate the stress (Sincero, 2012).

Emotion-focused coping strategy tries to reduce the negative emotional response associated with stress such as embarrassment, fear, anxiety, depression, excitement and frustration (McLeod, 2015) in the form of Rock Balancing activity. Through the use of emotion-focused coping strategy, it helped an individual to feel better but does not solve the source of distress. The Rock Balancing activity served as a tool in diverting the attention of the participants away from the thought of their stress factors momentarily. Since the activity needs pulse, attention, balancing and concentration, it enabled an individual in increasing its ability to focus as well as the sense of pleasure, positivity and contentment (Galor, 2012).

This strategy was effective in the management of unchangeable stressors (DeGraff&Schafer, 2008) as it involved cognitive reappraisal that includes self-reflection, taking control over one’s emotion (Carver, 2011). Emotion-focused strategy was primarily used in handling feelings of distress rather than the actual situation. Mostly, this strategy was for short-term solution for it does not fix the core of the problem itself. An example of this strategy was through distraction or keeping oneself busy to take one’s mind off the issue; meditation, with the use of mindfulness; or relaxation.

Through this theory, the Rock Balancing as stress-reduction activity induced served as an instrument in increasing the ability to focus and decreasing the feeling of distress. The said activity helped the participants to distract themselves from their source of stress.

## Conceptual Background

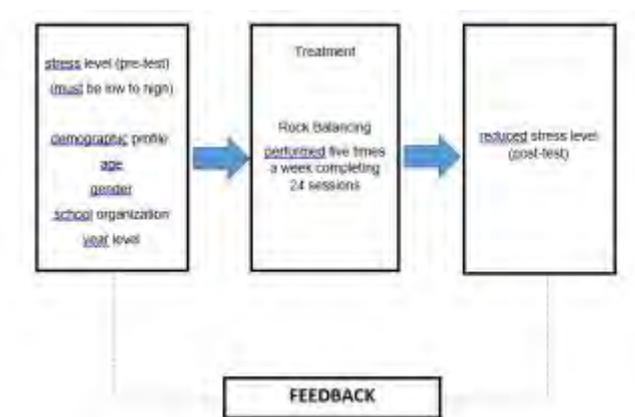


Figure 1. Research Paradigm

The conceptual framework explains the flow or direction of the study. It is a group of concepts that are broadly defined and systematically organized to provide an interpretation of information. Following the ABA pattern, wherein A is the baseline condition, B is the experiment or treatment condition, after which they would return to (A) to observe the effect before, during and after the treatment condition. (Cherry, 2016)

In this study, pattern (A) was the general stress test wherein each participant must obtain from a low to high stress level, and it was given before the intervention. Rock Balancing was pattern (B) which is the treatment condition of the study. After the intervention of rock balancing, the participants were returned to pattern (A) baseline condition wherein participants took again a general stress test to determine their stress level. Results of the pre- and post- general stress test were compared to determine the effectiveness of Rock balancing as coping strategy.

## **Research Design**

This study contained a Quantitative Experimental design. Quantitative research design is a type of broad distinction wherein numerical data are collected and analyzed. This research design is a formal, objective and systematic process of obtaining quantifiable information. It also explored the relationship between independent variable (Rock Balancing) and dependent variable (stress level of the student leaders of School of Arts and Sciences in Emilio Aguinaldo College - Cavite).

The study also includes the within-subjects design. A within-subject design, also called as repeated measures, is a design where all the levels of independent variable are administered sequentially to all subjects. In this study, the Rock Balancing applied was the independent variable and the dependent variable was the stress level of the student leaders after its pretest and post-test.

The researchers chose the within-subject design or ABA pattern design in order to identify whether the treatment was effective in reducing the stress level of the participants. The ABA design is a type of experimental design in which participants were first introduced to a baseline condition (A). In the baseline condition, no treatment or experimental variable was introduced. Next, the participants received the experimental condition or treatment (B), after which, they returned to the baseline condition (A). The ABA design allowed experimenters to observe behavior before treatment, during treatment and after treatment.

With the use of this pattern, the researchers were able to effectively determine if the Rock Balancing was effective in reducing the stress level of the participants by comparing their stress level before the activity as its baseline to the stress level after the activity.

## **Research Locale**

The researchers conducted the study at Emilio Aguinaldo College-Cavite. The experiment was conducted at the Psychology Laboratory for 24 sessions. The study was conducted within the college which enabled the researchers to have an optimum focus on the study. Also, with the use of Psychology Laboratory as the venue for the experiment proper, the execution of the treatment aided the researchers to have their information needed given with minimal extraneous variables.

## **Research Participants**

The respondents of this experimental study were student-leaders of School of Arts and Sciences in Emilio Aguinaldo-College Cavite. The study had ten participants which were selected through purposive sampling technique. In purposive sampling technique, the respondents were chosen based on their knowledge of the subject being studied or information designed. The main goal of purposive sampling is to focus on particular characteristic that are of interest which will best enable the researchers to answer the research questions. In this study, the target group were the student-leaders of School of Arts and Sciences in Emilio Aguinaldo College-Cavite having the criteria met for the guidelines. The participants in this study comprised of 5 student leaders from Arts and Sciences Student Council, 1 student leader from Communication Society and 4 student leaders from Psychology Society.

## **Data Gathering Tool**

The study about the effect of Rock Balancing in reducing the stress level of the student leaders of School of Arts and Sciences in Emilio Aguinaldo College-Cavite involved the following data gathering tools for the improvement of the study. (a) *Permission letters* asking the consent of the potential participants. The letter included the intention of giving out questionnaires; their involvement to the experiment and their rights and responsibilities as the participants; (b) *General Stress Test* adapted and modified by the researchers from the study of

Razafamahasolo (2012) in his study “Impact of Financial Literacy on Level of Stress and Academic Achievement among College Students”; *Informed consent* and the *ethical considerations* the participants already knew the purpose of the study, the researchers, their rights and their benefits; *guidelines for the Rock Balancing activity*. The guidelines will help the researchers and the participants to properly perform the experiment procedures minimizing extraneous variables; the *stones/rock* that served as the main instrument in performing the Rock Balancing. The rocks used were in irregular forms and shapes based on the original concept of the artistic Rock Balancing. Same set of stones (a total of 30 stones) were used in this experiment which was conducted individually. Also, the place to where the experiment was held, which was the Psychology Laboratory, was also needed to attain valid, consistent and fair results, minimizing the intervening variables within the participants and; *validated interview guide* was used for feedback gathering. Also, it included the use of audio recorder for accurate transcription of primary data.

## **Data Gathering Procedure**

The use of the related procedure, served as the study’s guide throughout the research. Having the experimental ABA pattern research design, the researchers lined their procedure with the study of Mohammadzaheri, Koegel, et.al about “A Randomized Clinical Trial Comparison between Pivotal Response Treatment (PRT) and Structured Applied Behavior Analysis (ABA) Intervention for Children with Autism”.

Before the data gathering procedure proper started, the researchers gave the general stress test for validation and reliability to fifteen random students.

Next, the researchers conducted purposive sampling in order to arrive with the pre-final list of participants. The researchers arrived with sixteen student-leaders of the School of Arts and Sciences asking for the participants’ availability of time as well as their approval. With the sixteen student leaders gathered, the researchers gave them the General Stress Test in order to arrive with the participants having from low to high level of stress. Another qualification to the study’s participant is to have from low to high level of stress. Only ten student leaders got low to high level of stress which made them the final participants of the study. The schedule of the participants’ activity was according to their common free time during weekdays.

To start the data gathering procedure, the participants take the letters for them to be knowledgeable about the procedures to be undertaken. Knowing their initial survey questionnaire results about general stress, Rock Balancing was applied.

Rock Balancing ran for 24 sessions (Mondays to Fridays). Having 24 sessions for this study was said to be acceptable for which emotion focused strategy is under Cognitive Behavior Therapy.

Brief cognitive behavioral therapy and counselling of 6-8 sessions over 10-12 weeks should be considered (Forde). Also, according to the American Psychological Association, many people improve significantly within eight to ten therapy sessions (Smith, Segal, R. & Segal, J, 2016).

The participants underwent a maximum of 15 minutes per session for 24 meetings. Each participant balanced same set of stones (a total of 30 stones) and it depends on them how high they will balance the stones. Each session ended after they had stacked the stones.

The first session was provided with seven (7) rocks. The succeeding sessions had an additional one rock to avoid mastery and to increase challenge in each session. An additional of one stone in each session increased the number of choices of stones to stack but it was always depending on them which and on how many stones they will balance.

The treatment was held in the same place (Psychology Laboratory) and was given individually.

After the whole session, the participants took the survey questionnaire on general stress to determine if Rock Balancing had worked enough in reducing their stress level.

After the 24th session of the treatment, the researchers proceeded to the feedback gathering of the participants. Through this, the participants were able to give their insights, comments and suggestions about the entire treatment.

After the entire treatment, the researchers debriefed the participants and explained the whole concept or purpose of the treatment. Through this, deception was prevented, by minimizing the bias or reaction formation throughout the study.

## **Data Analysis Procedure**

For the data analysis procedure of the Rock Balancing, the two means (stress level before the activity and stress level after the activity) were compared using the SPSS.

The SPSS or Statistical Package for Social Science tool was used to get the mean of the stress level of the participants and the comparison of the pretest and post test of the participants.

For this study, the researchers used the Statistical Package for the Social Science version 20.

Weighted mean was also used in this study. This was the average of the numbers and was also called as a calculated “central” value of a set of numbers. In getting the mean of the data in the study, the factors (numbers) are just added up and divided into its quantity. Weighted mean was used to determine the stress level of the participants based on the statistical limit of the instrument used in General Stress Test.

Frequency was also involved in the analysis wherein it showed the number of instances in which a variable (an effect, for example, in the feedback gathering) took place in each of its possible values. Through the mean of the stress level of the participants before and after the activity, the researcher will find out if there is a directive effect on the participant’s stress level. This shows either the actual number on observations of feeling in each range or the percentage of observations.

Paired t-test was also used for the data analysis of this study. The paired t-test calculated the difference with between before-and-after pair of measurements (pre-test and post-test of the participants), determined the mean of these changes, and reported whether this mean of the differences is statistically significant. By using the paired sample t-test, the researchers can statistically conclude whether or not the rock balancing activity reduce the stress of the participants.

Arriving at the data conclusion, the researchers gave the participants an update from what they have participated. It is stated in the American Psychological Association Code of Ethics that debriefing is important for the participants for them to know their value of participation in the study. With this, the data conclusions gathered by the researchers will give them insights on reducing their stress level for even a short period of time

## Results and Discussion

To discuss the results of the gathered data, the following tables were presented in order to show the frequency distribution of the demographic profile, stress level of the participants and their feedback during rock balancing activity.

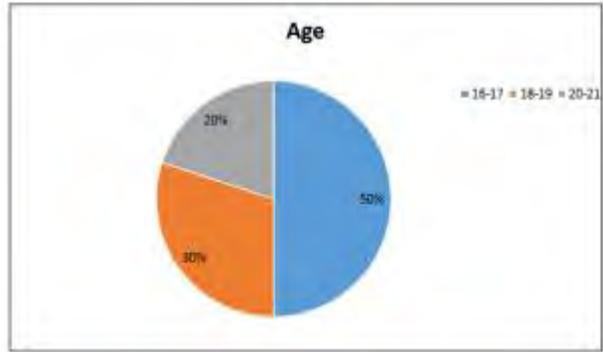


Figure 2. Frequency Distribution on the Demographic Profile of the Respondents in Terms of Age

This figure shows that 50% of the respondent's age are within the age range of 16-17 years old; 30% of the respondent's age were within the age range of 18-19 years old; and 20% of the respondent's age are within the age range of 20-21 years old.

Based on the frequency distribution of the participants' ages, table shows that half of the participants came from the age range of 16-17 years old; followed by the 18-19 years old and 20-21 years old age range. This table also shows that most of the student-leaders in School of Arts and Sciences were mostly in their younger age.

Based on the Journal of Leadership Education (2012) "Perceptions of Leadership: An Examination of College Students' Understandings of the Concept of Leadership" by Paige Haber, PhD, the finding suggests that younger students might place a greater focus on leadership as leading by example and with morals than their older counterparts. Since these younger students likely have less life experience and work experience than their older peers, this finding could suggest that younger students may be more idealistic when it comes to leadership and older students may see lack of role modelling or morality in their previous experiences.

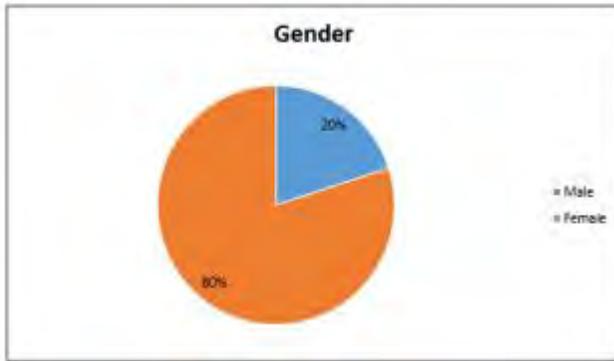


Figure 3. Frequency Distribution on the Demographic Profile of the Respondents in Terms of Gender

This figure shows that 80% of the respondents are female and 20% of the respondents are male. The table shows inequality with the quantity of gender among student-leaders in the School of Arts and Sciences as it gained more female students leaders than male. The probability of having more female student leaders than male student-leaders in the School of Arts and Sciences was high because most officers among the school organizations participated in the study (Arts and Sciences Council, Communication Society and Psychology Society) had more female officers than male.

Based on the article written by Jake New on [insidehighred.com](http://insidehighred.com), their studies found out that that women don't assert themselves as much in class discussions but still outperform male students. It was found out that female students preferred trying to "make a difference" in less visible positions, in student government and otherwise.

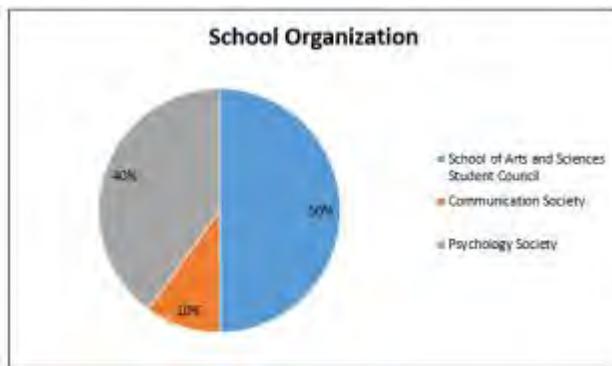


Figure 4. Frequency Distribution on the Demographic Profile of the Respondents in Terms of School Organization

This figure shows that 50% of the participants are student-leaders from the School of Arts and Sciences Council, and 40% of the participants are student-leaders from Psychology Society. Only 10% of the participants come from Communication Society.

Table shows that, there is unequal distribution of the respondents in the different school organizations. Since the study concerned with the three school organizations (School of Arts and Sciences Student Council, Psychology Society and Communication Society), their availability within the whole session, especially within the week was considered. The participants' commitment and willingness were also observed in participating in the 24 sessions of this experiment.

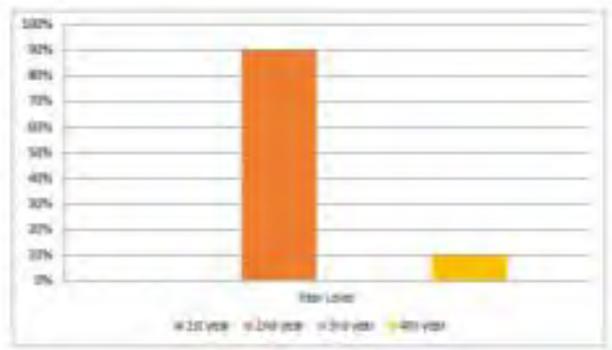


Figure 5. Frequency Distribution on the Demographic Profile of the Respondents in Terms of Year Level

This figure shows that 90% of the respondents are in their second year and the remaining 10% are in their fourth year. The distribution of the respondents is unequal due to the qualification released by the Office of the Student Affairs to every elected student leaders of school organizations. In addition to that, based on the academic curriculum of the programs under the School of Arts and Sciences, it is quite unmanageable for the higher levels (third year and fourth year levels) to spare their time with absolute willingness despite of huge number of academic requirements.

Based on the Journal of Leadership Education (2012) “Perceptions of Leadership: An Examination of College Students’ Understandings of the Concept of Leadership” by Paige Haber, PhD, the finding suggests that younger students might place a greater focus on leadership as leading by example and with morals than their older counterparts. Since these younger students likely have less life experience and work experience than their older peers, this finding could

suggest that younger students may be more idealistic when it comes to leadership and older students may see lack of role modelling or morality in their previous experiences.

In addition, a study by MacGregor (2001), in some ways, young leaders are a step ahead of non-traditional leaders because they generally have already engaged in some type of visible leadership experiences. These experiences may include participation in a school committee, athletic participation through childhood, running for a secondary leadership position, club membership, youth group participation, or attending a leadership workshop. In doing these activities, these students have started to self-actualize whether or not they enjoy taking on the roles related to being leaders.

Table 1

*Stress Level of Each Participant in Pretest and Post Test Participants*

Participants	Pre-test (Weighted Mean)	Stress level	Post-test (Weighted Mean)	Stress level
1	2.10	Low	2.03	Low
2	2.23	Low	2.33	Low
3	2.17	Low	1.73	Low
4	1.90	Low	1.93	Low
5	2.87	High	2.20	Low
6	1.93	Low	2.03	Low
7	2.87	High	2.33	Low
8	2.83	High	2.23	Low
9	2.80	High	2.80	High
10	2.37	Low	2.33	Low

*Statistical limits: Very High= 3.51-4.00, High= 2.51-3.50, Low=1.51-2.50 and Very Low=1.00-1.50*

This table shows the weighted mean and stress level of each participant in pre-test and post-test. Four out of ten participants acquired high stress level which ranges from 2.51 to 3.50, and six out of ten participants obtained low stress level which ranges from 1.51 to 2.50 in the pre-test. In post-test, nine out of ten participants gained a low stress level which ranges from 1.51 to 2.50 and one out of ten participants attained a high stress level which ranges from 2.51 to 3.50.

There were six out of ten participants obtained a lower weighted mean in post-test while three out of 10 participants acquired a higher weighted mean in post-test. One out of ten participants attained the same weighted mean in pre-test and post-test.

Six out of ten participants obtained a lower weighted mean stress level in post-test. Three out of the ten participants were reported to have a downgrade in their stress level from “high” to “low”, three out of the ten participants had a lower weighted mean stress level but retained its verbal interpretation as “low”. On the other hand, the remaining three out of ten participants acquired the same verbal interpretation (low) but noted to have an increased weighted mean stress level. An outstanding participant among the ten participants retained verbal interpretation of “high” and so as its weighted mean stress level.

The result shows that Rock Balancing activity had affected to the stress level of the participants. But, the effect did not guarantee that the implemented treatment among the participants was effective enough in reducing the participants’ level of stress in pre-test and post-test.

Statistically speaking, rock balancing seemed to have a positive effect to the six participants and negative effect to the other three participants. On the other hand, the remaining one participant retained its stress level and its verbal interpretation as well.

Table 2

<i>General Weighted Mean for Pre-Test</i>		
Type of Stress	Weighted Mean	Verbal Interpretation
Physical	2.06	Low
Cognitive	2.01	Low
Psychosocial	2.46	Low
General Weighted Mean	2.18	Low

This table shows the weighted mean of the physical, cognitive and psychosocial stress of the student-leaders of the School of Arts and Sciences in their pre-test.

The physical stress obtained its weighted mean of 2.06 which is interpreted as low (1.51-2.50); cognitive stress attained its weighted mean of 2.01 which is interpreted as low (1.51-2.50) and; psychosocial stress acquired its weighted mean of 2.46 which is interpreted as low (1.51-2.50).

Among the three areas of stress, the psychosocial stress scored the highest in terms of its weighted mean, but is then, remained “low” in terms of verbal interpretation (verbal interpretation and instrument Likert scale used from the adapted and modified work of Razafamahasolo in

2012 ‘Impact of Financial Literacy on Level of Stress and Academic Achievement among College Students’).

The pre-test’s general weighted mean was also reported which obtained a 2.18 which was verbally interpreted and “low”.

In Onditi’s study (2014) entitled “Psychosocial Stressors and Help-Seeking Behavior among Undergraduate Student-Teachers in Tanzania”, from the International Journal of Learning & Development, he stated that “the longer the students stay at the University the more stressful they become. In order of severity, generally, majority of students across years of study reported that academic, accommodation, and financial hardship as the major stressors, followed by future career, health, relationship and social related problems”.

Table 3

*General Weighted Mean for Post-Test*

Type of Stress	Weighted Mean	Verbal Interpretation
Physical	2.19	Low
Cognitive	2.00	Low
Psychosocial	2.40	Low
General Weighted Mean	2.19666	Low

This table shows the weighted mean of the physical, cognitive and psychosocial stress of the student-leaders of different school organizations in their post-test.

The physical stress has its weighted mean of 2.19 which is interpreted as low (1.51-2.50); cognitive stress has its weighted mean of 2.00 which is interpreted as low (1.51-2.50) and; psychosocial stress has its weighted mean of 2.40 which is interpreted as low (1.51-2.50).

Among the three areas of stress, the psychosocial stress scored the highest in terms of its weighted mean, but is then, remained “low” in terms of verbal interpretation (verbal interpretation and instrument likert scale used from the adapted and modified work of Razafamahaso in 2012 ‘Impact of Financial Literacy on Level of Stress and Academic Achievement among College Students’).

In association with the general weighted mean of the three types of stress in pre-test, it is reported that the general weighted mean for physical stress had an increase after the post-test (from 2.06 to 2.19). The

general weighted mean for cognitive and psychosocial stress were reported to have a decrease in their general weighted mean after the post-test (2.01 to 2.00 for cognitive stress, and 2.46 to 2.40 for psychosocial stress). Therefore, it was noted that the null hypothesis was rejected because the implemented treatment had effected to the stress level of the participants. Due to the study's results, the rejected null hypothesis was supported for the results bore an increase in the stress level for physical stress, and a decrease in the stress level of cognitive and psychosocial.

According to Seif and Starub's study (2011, 2007), psychosocial stressors are psychological and social events that may cause stress among college and university students which includes: academic, financial problems, relationship, time management, health concerns, social and personal problems and future career plans.

Based on the article of McEwen and Tucker (2009) it shows the evidence of adverse effects of psychosocial stress on health and its modifying effect on the relationship between exposure to environmental agents and health outcomes. The primary objective of this article is that it explains how the presence or perception of environmental contamination may lead to psychosocial stress in the community, family and individual.

However, the weighted mean in post-test of physical stress became higher compared to its weighted mean in pre-test (2.06 in pre-test; 2.19 in post-test), but is still remained in the "low" interpretation.

Table 4

*Summary of Paired Sample Test in Pre-test and Post-Test in the Three Types of Stress*

Type of Stress	P-value	Decision
Physical	0.004	Reject Ho
Cognitive	0.000	Reject Ho
Psychosocial	0.001	Reject Ho

The computed significance value in the three types of stress in pre-test and post-test is all less than 0.05, which means there was a significant difference between the pretest and post-test of the participants. All of the computed p-value in the three types of stress are all less than 0.05, which means that the independent variable (rock balancing activity) made the difference which means, and not likely due to chance alone. The decision was to reject the null hypothesis because rock balancing had effected the physical, cognitive and psychosocial stress of the participants

However, having a significant difference does not prove that rock balancing had reduced the stress of the participants, it either increase or decrease the stress of the participants. Rock balancing was effective only in reducing the cognitive and psychosocial stress of the participants as shown in Table 2 and Table 3.

TheTable 5 below shows the frequency, percentage and ranking of the effects of the rock balancing activity gathered with the use of interview guide. According to the participants, rock balancing had an effect with them in developing their concentration and they also found the activity as entertaining; 90% said that the intervention had an effect with them by relieving their stress temporarily, and they would recommend the activity to others. Rock balancing activity, according to 80% of the participants, had an effect with them in reducing their stress. It also resulted to diverting their attention to their stressors and also relaxing their emotions. However, 50% of the participants said that they felt frustrated during the course of the activity. According to 20% of the participants, the activity developed their balancing skills and lastly, only one of them found the activity to be challenging.

“The most fundamental non-physical element is harder to explain through words. In a nutshell, I am referring to meditation, or finding a zero point or silence within yourself. Some balances can apply significant pressure on your mind and your patience” Michael Grab (2011).

Table 5

*Effects of Rock Balancing Activity as Perceived by the Participants*

Effects of Rock Balancing According to the Participants	Frequency	Percentage	Rank
1. Reduces stress	8	80%	3
2. Relaxes emotion	8	80%	3
3. Develops concentration	10	100%	1
4. Diverts attention	4	40%	5
5. Challenges Patience	1	10%	7
6. Creates entertainment	10	100%	1
7. Causes frustration	5	50%	4
8. Develops his/her balancing skill	2	20%	6

On an article written by Grab, he stated that he has a number of reasons over the past few years of balancing rocks. His first impression gave him a nice feeling and the meditative aspect of balancing is relaxing. Rock Balancing is about focus through a simple yet challenging act. It is not about making something for someone else (Excerpt from Relaxation: Rock Stacking and the Art of Balance 2013 retrieved from [www.simplysonoma.co](http://www.simplysonoma.co)).

## **Conclusion**

1. Findings showed that majority of the participants' ages were ranging from sixteen to seventeen years old. Most of the participants were female, majority of them were in their second year, and were student-leaders from the School of Arts and Sciences Student Council. Therefore, it is concluded that younger students and mostly females are more active in participating in student organizations.
2. Based on the results, four out of ten participants got the high level of stress in pre-test and nine out of ten participants got the lower level of stress in post-test. Therefore, it is concluded that rock balancing lowered the stress levels of the participants after the activity.
3. The general stress test has three areas – physical-biological, cognitive and psychosocial. Based on the findings, the computed value between the pre and post-test in physical-biological is .004, cognitive is .000, and psychosocial is .001. Therefore, it is concluded that rock balancing had positive effects on reducing the cognitive and psychosocial stress level of the participants as shown on the pre-test and post-test.
4. Based on the findings, it is concluded that rock balancing has different perceived effects to different student-leaders. Rock balancing helped in concentration, reduction of stress, and relaxation. Also, it is said to be frustrating and does not relieved stress permanently.

## **Recommendation**

Based on the result of the study, the researchers would like to recommend the following:

1. For the student-leaders, the researchers would like to recommend the administration of rock balancing activity for a longer period of time to have a more positive effect towards reducing stress.

2. For School Administration, the researchers would like to suggest the use of rock balancing as a stress reduction activity especially to their student-leaders and the faculty. For the parents, this study can also provide information in which they can suggest rock balancing or other alternative stress reducing activities to their children and other family members.

3. For Professional Practitioners, the researchers would like to suggest the rock balancing to reduce the stress of their clients.

4. For future researchers, this study will serve as a basis or reference for them if they will conduct the same or related study. Future researchers that will conduct the same experiment should increase the number of participants and duration of the experiment and conduct rock balancing activity in a more controlled setting.

It is also suggested for future researchers to have an equal number of female and male student-leaders since the study only contained 20% from male respondents in this study. Also, it is suggested for the future researchers to conduct the study in a wider range of student organizations that can participate since this study only focused on three organizations/councils which are the School of Arts and Sciences Student Council, Communication Society and Psychology Society.

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# **Isang pananaliksik sa mga mabisang pamamaraan ng pagtuturo ng piling panitikan sa Ikapitong Baitang ng Immaculate Conception Academy—East**

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## **Abstrak**

Ang panitikan ay isang bahagi ng pag-aaral ng Filipino na nauukol sa mga pangyayari na naisatitik, maaring ito ay kathang-isip o ayon sa katotohanan na pinagkukunan natin ng ating kultura, aral, kaugalian at mga kasaysayan mula sa tula, mito, alamat, maikling kwento, nobela at iba pa. Upang matukoy ang mga suliranin ng kawalan ng interes na pag-aralan ang panitikan, ginamit sa riserts na ito ang palawarang pananaliksik. Ang mga respondente ay 114 na mag-aaral ng panitikan, 5 guro na nagtuturo ng panitikan at ang mga istrategiya sa ginagamit sa pagtuturo ng panitikan. Ang instrumento na ginamit sa pagkalap ng datos ay isang sarbey na may 12 katanungan na parehong sinagot ng mag-aaral at ng guro. Ayon sa datos: sa mga mag-aaral nanaig ang kagustuhan sa pagkukwento, presensiya ng guro, pagpapaliwanag ng talasalitaan, paggamit ng *visual aids* at dula-dulaan; at sa panig ng mga guro nanguguna ang dula-dulaan, paggamit ng teknolohiya, pag-uugnay ng karanasan, pagpapaliwanag ng talasalitaan, at pagkukwento. Bilang kongklusyon, nakikita ng mga mananaliksik na ang guro at ang mga mag-aaral ay may taliwas na pananaw. Isang patunay lamang na maaring ang direksyon na aayon sa sukdulang pagkakatuto ng mag-aaral ng panitikan ay nangangailangan pa ng masusing kasagutan.

***Mga Susing Salita:*** Pananaliksik, panitikan, pamamaraan.

## **Introduksyon**

Ang mataas na kalidad ng edukasyon ay nangangailangan ng mga mabisang pamamaraan ng pagtuturo lalo na sa larangan ng panitikan. Ang panitikan ay sinasabing isang bahagi ng pag-aaral ng Filipino. Isa itong yamang maituturing ng isang bansa sapagkat dito nakasaad ang kasaysayan ng pagkabihag, paglaya, pinagmulan ng mga bagay, mga kathang-isip na may tema ng pag-ibig, pagkamuhi, galak, lungkot, awa, paghihiganti at iba pa. Kaya, masasabing ito ay elemento na kasama sa pag-unlad ng isang bansa.

Ayon kay G. Azarias, “Ang panitikan ay nagpapahayag ng damdamin ng tao tungkol sa iba’t ibang bagay sa daigdig, sa pamumuhay, sa pamahalaan, sa lipunan at sa kaugnayan ng kanilang kaluluwa sa Dakilang Lumikha.”

Ayon naman kay Luz A. de Dios, “ang panitikan ay mula sa mga pangyayaring sinatitik at pinalamutian.”

Samakatwid, dahilan mayaman ang panitikan, nararapat na magkaroon ng di-matatawarang pagmamalasakit na kilalanin, bigyang-halaga at pag-aralan ang mga ito nang sa gayon ay lalong mapagyaman at mabigyang-kariktan para sa susunod pang salinlahi.

Sa kabila ng mga nabanggit na kahalagahan ng pag-aaral ng panitikan, suliranin sa gitna ng mga mag-aaral ang kawalan ng interes na makinig sa araling ito lalo pa ang magbasa ng mga sulatin. Pinatunayan ito ni Paquito B. Badayos (2011) nang sabihin niya na wala sa interes ng mga mag-aaral ang magbasa ng panitikan.

Layunin ng pag-aaral na ito na tuklasin ang mga mabisang pamamaraan ng pagtuturo ng piling panitikang Filipino ayon sa mga guro at mag-aaral upang mas maging epektibo ang pagtuturo-pagkatuto na dapat mangyari sa loob ng silid-aralan; makapagbigay ng suhestyon at rekomendasyon kapwa sa mga guro at mag-aaral ng Immaculate Conception Academy – East.

### **Kahalagahan ng Pag-aaral**

Mahalaga ang pag-aaral na ito sa Kagawaran ng Edukasyon na magbigay nang higit na pansin sa mga seminar at pagsasanay ukol sa mga pamamaraan ng pagtuturo upang mas maging epektibo at interaktibo ang talakayan sa loob ng silid-aralan at lalong mapaunlad ang kalidad ng edukasyon; sa guro, na magsilbing pagbubukas ng kaisipan na sa pagtuturo ay may maraming pamamaraan subalit may pamamaraan na sadyang mabisa; sa mag-aaral, na ang panitikan ay dapat pag-aaralan

sapagkat ito ay naglalaman ng kasaysayan, kultura, kaugalian, at aral na kapupulutan; at sa mga mananaliksik, anumang resulta ay maaari magamit ang pag-aaral na ito sa pagdaragdag ng mga impormasyon na kakailanganin sa pananaliksik.

### Balangkas Teoritikal

Ang pinagbatayan ng pag-aaral na ito ay ang *Transfer Theory* (Highet: 1950), na nakatuon sa mga kaalaman na naipapasa ng guro patungo sa mga mag-aaral sa pamamagitan ng mabibisang elemento sa pagtuturo tulad ng mgaistratehiya, kaalaman, at mga teknik. Nararapat na maging malawak ang kaalaman at kaisipan ng guro upang maisagawa ang istrategiya nang maayos at kawili-wili at gayundin ay mapukaw ang interes ng mag-aaral na matutunan ang bawat aralin.

### Disensyo ng Pananaliksik

Ginamit ng pag-aaral na ito ang palarawang pananaliksik na akda nila Best at Khan noong 1996 at nagkaroon ng bagong akda noong 2006. Sumasaklaw ito sa pagsisiyasat, pagsusuri, pagtatala, at pagpapakahulugan ng mga datos nang sa gayon ay makabuo ng panlahatang pananaw na nakatulong sa pag-unawa at nakapagbigay ng mga prodyeksyon sa hinaharap.

## Mga Resulta at Talakayan

### Talahanayan Blg. 1

Pamamaraan	Oo		HINDI	
	Bilang	Bahagdan	Bilang	Bahagdan
	3	60%	2	40%
1. Pagkukwento	5	100%		
2. Dula-dulaan	5	100%		
3. Paggamit ng Teknolohiya	3	60%	2	40%
4. Paggamit ng Visual Aids	4	80%	1	20%
5. Pagpapalivanag ng Talasalitaan	4	80%	1	20%
6. Pag-uugnay ng mga Karanasan	3	60%	2	40%
7. Presensya ng Guro	1	20%	4	80%
8. Cue Cards	1	20%	4	80%
9. Comic Strip			5	100%
10. KWL				
11. Story Frame				
12. Story Ladder				

Sa Talahanayan Blg. 1, ipinapakita ang bilang ng mga guro na sumagot ng OO o HINDI sa mabisang mga pamamaraan sa pagtuturo ng piling panitikan.

Sa kabuuang limang tagatugon, 5 o may katumbas na 100% ang nagsabing OO na mabisang pamamaraan ng pagtuturo ng piling panitikan ang paggamit ng teknolohiya at dula-dulaan. Sinusundan ng pagpapaliwanag ng talasalitaan at pag-uugnay ng karanasan ng mga guro na may 4 o may katumbas na 80% ang nagsabi ng OO at 1 o may katumbas na 20% ang nagsabi ng HINDI. Kasunod nito ay ang pagkukwento, paggamit ng *visual aids*, presensya ng guro at paggamit ng *comic strip* na may 3 o may katumbas 60% ang nagsabing OO at 2 o may katumbas na 40% ang nagsabing HINDI mabisang pamamaraan ng pagtuturo ng piling panitikan. Sa paggamit ng *cue cards* ay may 2 o may katumbas na 40% ang sumagot ng OO at 3 o may katumbas na 60% ang nagsabi ng HINDI mabisang pamamaraan sa pagtuturo ng panitikan. Mapupuna rin na ang KWL at *story frame* na may 1 o may katumbas na 20% ang nagsabing hindi ito mabisa sa pagtuturo ng piling panitikan. Samantalang ang *story ladder* na may 5 o may katumbas na 100% ang nagsabi ng HINDI ito mabisang pamamaraan sa pagtuturo ng piling panitikan.

Makikita sa Talahanayan Bilang 1 ang mga tugon ng mga guro sa Immaculate Conception Academy.

Sa Talahanayan Blg. 2, ipinapakita ang bilang ng mga mag-aaral na sumagot ng OO o HINDI napupukaw ang interes ng mga mag-aaral sa pamamaraang ginagamit ng mga guro sa pagtuturo ng piling panitikan.

Sa kabuuang 114, ang pagkukwento ay pamamaraang nangingibabaw na may 113 o may katumbas na 99% ang sumagot ng OO at 1 o may katumbas na 1% ang sumagot ng HINDI na pupukaw ang interes sa pag-aaral ng piling panitikan. Ang presensiya ng guro ay mahalaga sa 109 o may katumbas na 95% na sumagot ng OO at 5 o may katumbas na 5% ang nagsabi na HINDI. Sinundan ng pagpapaliwanag ng talasalitaan na may 105 o may katumbas na 92% ang nagsabi ng OO at 9 o may katumbas na 8% ang nagsabi ng HINDI. Kasunod ay ang paggamit ng *visual aids* na may 100 o may katumbas na 87% ang sumagot ng OO at 14 o may katumbas na 13% ang sumagot ng HINDI. Ang Dula-dulaan ay may 97 o may katumbas na 85% ang nagsabi ng OO at 17 o may katumbas na 15% ang nagsabi na HINDI. Samantalang ang pag-uugnay ng karanasan ay may 96 o may katumbas na 84% ang sumagot ng OO at 18 o may katumbas na 16% ang sumagot ng HINDI. Ang *story frame* ay may 92 o may katumbas na 79% ang sumagot ng OO at 23 o may katumbas na 21% ang sumagot ng HINDI. Ang KWL ay may 88 o may katumbas na 77% ang sumagot ng OO at 26 o may

katumbas na 23% ang sumagot ng HINDI. Ang *story ladder* ay may 84 o may katumbas na 73% ang sumagot ng OO at 30 o may katumbas na 27% ang sumagot ng HINDI. Ang *comic strip* ay may 83 o may katumbas na 72% ang sumagot ng OO at 31 o may katumbas na 28% ang sumagot ng HINDI. Kapuna-puna na ang paggamit ng teknolohiya ay may 80 o may katumbas na 70% ang sumagot ng OO at 34 o may katumbas na 30% ang sumagot ng HINDI. At ang huli ay ang paggamit ng *cue cards* na may 68 o may katumbas na 59% ang sumagot ng OO at 46 o may katumbas na 41% ang sumagot na HINDI ito nakapupukaw ng interes sa pagtuturo ng piling panitikan.

## Talahanayan Blg. 2

Makikita sa Talahanayan Bilang 2 ang mga tugon ng mga mag-aaral ng Immaculate Conception Academy – East.

Pamamaraan	OO		HINDI	
	Bilang	Bahagan	Bilang	Bahagdan
1. Pagkukwento	113	99%	1	1%
2. Dula-dulaan	97	85%	17	15%
3. Paggamit ng Teknolohiya	80	70%	34	30%
4. Paggamit ng Visual Aids	100	87%	14	13%
5. Pagpapaliwa nag ng Talasalitaan	105	92%	9	8%
6. Pag-uugnay ng mga Karanasan	96	84%	18	16%
7. Presensya ng Guro	109	95%	5	5%
8. Cue Cards	68	59%	46	41%
9. Comic Strip	83	72%	31	28%
10. KWL	88	77%	26	23%
11. Story Frame	92	79%	23	21%
12. Story Ladder	84	73%	30	27%

Natuklasan sa Talahanayan Bilang 1 na ayon sa guro, ang paggamit ng teknolohiya at dula-dulaan ang may pinakamataas na bahagdan na siyang ginagamit ng mga guro sa pagtuturo ng piling panitikan na umaayon na sa kalakaran ng pagtuturo ng K-12 Kurikulum.

Natuklasan sa Talahanayan Bilang 2 na ayon sa mga mag-aaral, ang pagkukwento ang may pinakamataas na bahagdan na pamamaraang mabisa at sinusundan ng presensya ng guro na masasabing tradisyunal.

Natuklasan na hindi tumutugma ang pamamaraang ginagamit ng mga guro sa pagtuturo ng piling panitikan sa paraang ninanais ng mga mag-aaral.

## **Kongklusyon**

Batay sa nakalap na datos at lagom ng natuklasan, humantong ang mga mananaliksik sa sumusunod na kongklusyon:

1. Sa kabuuan, ang pamamaraang paggamit ng teknolohiya at dula-dulaan ay nangingibabaw na mabisang pamamaraan sa pagtuturo ng piling panitikan ayon sa mga guro.
2. Sa kabuuan, ang pamamaraang pagkukwento ay nangingibabaw na mabisang pamamaraan sa pagtuturo ng piling panitikan ayon sa mga mag-aaral.
3. Sa kabuuan, ang pamamaraang gamit ng mga guro sa pagtuturo ng piling panitikan ay hindi tumutugma sa pamamaraang nais ng mga mag-aaral sa pagtuturo ng piling panitikan.

## **Rekomendasyon**

1. Inirerekomenda sa mga guro na magkaroon ng training, workshop at seminar partikular para sa istrategiya at dulog ng pagtuturo ng panitikan.
2. Inirerekomenda sa mga mag-aaral na magkaroon ng bukas na kaisipan sa pagbabago na naaayon na sa paraan ng pagtuturo ng K-12 Kurikulum.
3. Inirerekomenda sa mga guro at mag-aaral na magkaroon ng iisang kaisipan sa pamamaraan ng pagtuturo ng piling panitikan nang sa gayon ay marating ang sukdulang pagkatuto ng asignaturang Filipino.

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# **Management of inmates in Cavite Provincial Jail and Trece Martires City Jail: A comparative study**

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## **Abstract**

This study aimed to determine the operational and administrative management of inmates in Cavite Provincial Jail and Trece Martires City Jail in terms of manpower, facilities, development program and discipline. A face-to-face interview was done to selected inmates and personnel of both jail facilities. The descriptive-correlational method was used to create a usable description on the topic. The gathered data were analyzed and interpreted. Thus, it was found out that there is no significant difference between the management of Cavite Provincial Jail and Trece Martires City Jail in terms of operation and administration. Thus, the study may provide significant information not only to these institutions but with other jails in the country.

**Keywords:** inmates, Provincial Jail, City Jail, jail facilities

## Introduction

Nowadays, overpopulation in jail is one of the problems in our country. According to International Center for Prison Studies 2013, Philippines is 4<sup>th</sup> in rank of the most overcrowded jail around the globe; and some of this problem is the Management of Prison or Jail in our country. But what is management? According to Harold Koontz, "Management is the art of getting things done through and with people in formally organized groups". Under management are Operational and Administrative Organization. Operation is the management which refers to the administration of business practices to create the highest level of efficiency possible within an organization. It is concerned with converting materials and labor into goods and services as efficiently as possible to maximize the profit of an organization. An Administrative Management is the process of managing information through people. This usually involves performing the storage and distribution of information to those within an organization. A large number of roles within business require some element of administrative management.

The principal purposes of the United Nations, as set out in the Preamble to the Charter of the United Nations and the Universal Declaration of Human Rights said that, "There shall be no discrimination on grounds of race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth or other status. On the other hand, it is necessary to respect the religious beliefs and moral precepts of the group to which a prisoner belongs"

All standards and norms in crime prevention and criminal justice developed at the request of the Commission on Crime Prevention and Criminal Justice and adopted or recommended by the General Assembly, or adopted by a United Nations congress on the prevention of crime and the treatment of offenders, and recognizing that the Universal Declaration of Human Rights is a source of inspiration for the United Nations standards and norms in crime prevention and criminal justice,

Bureau of Jail Management and Penology was created on January 2, 1991 by virtue of Republic Act No. 6975, also known as the Department of the Interior and Local Government Act of 1990. Prior to its creation, the Office of Jail Management and Penology of the Philippine Constabulary - Integrated National Police was the agency handling the local penology of the Philippines. It aimed to separate the agency from the national police, reporting directly to the Secretary of the Interior and Local Government.

Provincial Jail System was first established in 1910 under the American regime supervised and controlled by the provincial government and headed by the Provincial Jail Warden.

Cavite Provincial Jail is dedicated to the supremacy of law and order in Cavite, occupied by its first tenants on February 28, 1958 and formally inaugurated on September 5, 1961.

Trece Martires is the largest, most remote and one of the oldest barangays of Tanza, Cavite. It became city on the time of President Ramon Magsaysay and was named in the honor of the Thirteen Martyrs of Cavite, who were sentenced to death during the Spanish Regime.

Trece Martires City Jail before was located at the Cavite Provincial Capitol Compound and transferred to its present location in 2004. It is located at the roof top of a two-storey building of City Hall Annex Building, wherein the occupants are the City Health Unit Office, Municipal Trial Court in Cities, City Prosecutor and Cavite State University (ground floor). The jail is surrounded with welded wire with barb wire above. It has Six (6) cells wherein 5 for male inmates and 1 for female inmates, reception area, visitor's area, personnel quarters and admin and warden's office. This jail has operational jurisdiction over inmates whose cases fall before the Municipal Trial Court in City (MTCC) and the Regional Trial Court (RTC) Branch 23 of Trece Martires City, Cavite.

### **Objectives**

1. To compare the sufficiency of manpower in Cavite Provincial Jail and Trece Martires City Jail.
2. To know if the Developmental Program helps the inmate to improve their behaviour.
3. To compare the efficiency of disciplinary program in Cavite Provincial Jail and Trece Martires City Jail.

## **Methodology**

### **Research Design**

This study used the descriptive-correlational method to create a usable description on the topic Management of Inmates in Cavite Provincial Jail and Trece Martires City Jail. Descriptive studies are usually the best methods for collecting information that will demonstrate the relationships and describe the word as it exists.

## Research Subjects

Participants were 25 personnel and 100 inmates from Cavite Provincial Jail; and 10 personnel and 45 inmates from Trece Martires City Jail.

## Research Instruments

The researchers formulated sets of questions based on the objectives sought for the study. It gone through face and content validation at the same time a test of reliability was done.

## Data Gathering Procedures

The researchers personally administered the research instrument to the respondents. They conferred and discussed the significance of the study and accomplished the distribution of the instruments property.

## Data Analysis

Descriptive statistics was used for the study particularly percentage, rank and weighted mean.

## Results and Discussion

### I. Employee

Table 1

*Comparison between the Age of Personnel*

Age	Provincial Jail		City Jail	
	Percentage	Rank	Percentage	Rank
18 – 21	0		0	
22-25	4	5 <sup>th</sup>	0	
26-29	4	5 <sup>th</sup>	0	
30-33	8	4 <sup>th</sup>	20	1 <sup>st</sup>
34-37	12	3 <sup>rd</sup>	10	2 <sup>nd</sup>
38-41	12	3 <sup>rd</sup>	20	1 <sup>st</sup>
42-45	12	3 <sup>rd</sup>	20	1 <sup>st</sup>
46-49	0		10	2 <sup>nd</sup>
50-53	20	1 <sup>st</sup>	20	1 <sup>st</sup>
54-57	16	2 <sup>nd</sup>	0	
Above 57	12	3 <sup>rd</sup>	0	

Table 1 shows the personnel's age for both Cavite Provincial Jail and Trece Martires City Jail. Majority of the employees of Cavite Provincial Jail belongs to age bracket 50- 53 years old; while in Trece Martires City Jail were 30-33, 38-41 and 50-53 years old.

Table 2

*Comparison between the Educational Attainment of Personnel*

Educational Background	Provincial Jail		City Jail	
	Percentage	Rank	Percentage	Rank
Elementary	0		0	
High School	12	2 <sup>nd</sup>	0	
College	88	1 <sup>st</sup>	90	1 <sup>st</sup>
Post graduate	0		10	2 <sup>nd</sup>

Table 2 shows that 22 or 88% of the employees in Cavite Provincial Jail were college graduate; while 3 or 12% of them were high school graduate. On the hand, the employees from Trece Martires City Jail were mostly college graduate.

Table 3

*Comparison between the Length of Service of Personnel*

Length of service	Provincial Jail		City Jail	
	Percentage	Rank	Percentage	Rank
Below 1	8	4 <sup>th</sup>	0	
2 – 3-	8	4 <sup>th</sup>	10	3 <sup>rd</sup>
4 – 5	16	2 <sup>nd</sup>	50	1 <sup>st</sup>
6 – 7	12	3 <sup>rd</sup>	10	3 <sup>rd</sup>
Specify	56	1 <sup>st</sup>	30	2 <sup>nd</sup>

Table 3 shows that 56% of the employees in Cavite Provincial Jail were employed for more than 7 years; followed by those who were with the institution for 6-7 years; while most of the employees of Trece Martires City Jail were serving the City Jail between 4 to 5 years; followed by 2 to 3 years in the service.

Table 4

*Comparison between the Gender of Personnel*

Gender	Provincial Jail		City Jail	
	Percentage	Rank	Percentage	Rank
Female	32	2 <sup>nd</sup>	40	2 <sup>nd</sup>
Male	68	1 <sup>st</sup>	60	1 <sup>st</sup>
Lesbian	0		0	
Gay	0		0	
Bisexual	0		0	
Transgender	0		0	
Queer	0		0	

Table 4 shows that in Cavite Provincial Jail, there were 68% male and 32% were female; while in Trece Martires City Jail majority of the employees were also male with 60% and only 40% were female.

Table 5

*Comparative Assessment on the Management of Provincial Jail and Trece Martires City Jail as perceived by Personnel*

Categories	Provincial Jail		City Jail	
	Weighted Mean	Verbal Interpretation	Weighted Mean	Verbal Interpretation
Manpower	2.88	Good	3.22	Good
Facilities	2.52	Good	2.28	Fair
Development Program	3.11	Good	2.90	Good
Discipline	3.21	Good	3.36	Good
OVERALL	2.86	Good	2.94	Good

*Legend. 3.50 to 4.00 – excellent; 2.50 to 3.49 – good; 1.50 to 2.49 – fair; and 1.00 to 1.49 – poor*

Table 5 shows that Cavite Provincial Jail, Discipline category has the highest weighted mean which is 3.21 with the verbal interpretation of Good; while Trece Martires City Jail, Discipline category also has the highest weighted mean of 3.36 with the verbal interpretation of good.

Based on z-test of two independent proportions, there is no significant difference between the perception of the jail employees in terms of the management of their respective offices ( $z = 0.242, 0.01$ ).

## II. Inmates

Table 6

### *Comparison of the Age of Inmates*

Age	Provincial Jail (n=100)		City Jail	
	Percentage	Rank	Percentage	Rank
18 – 21	4	7 <sup>th</sup>	4	7 <sup>th</sup>
22-25	8	6 <sup>th</sup>	16	3 <sup>rd</sup>
26-29	9	5 <sup>th</sup>	4	7 <sup>th</sup>
30-33	27	1 <sup>st</sup>	27	1 <sup>st</sup>
34-37	19	2 <sup>nd</sup>	11	4 <sup>th</sup>
38-41	11	3 <sup>rd</sup>	18	2 <sup>nd</sup>
42-45	10	4 <sup>th</sup>	9	5 <sup>th</sup>
46-49	8	6 <sup>th</sup>	7	6 <sup>th</sup>
50-53	2	8 <sup>th</sup>	4	7 <sup>th</sup>
54-57	0		0	
Above 57	2	8 <sup>th</sup>	0	

Table 6 shows the inmates' age on for both Cavite Provincial Jail and Trece Martires City Jail. Majority of the inmates of Cavite Provincial Jail were aged 30-33 years old, followed by 34-37 years old, and lastly were 50-53 years old; while in Trece Martires City Jail, most of them were 30-33 years old, followed by 38-41 years old, and lastly inmates were aged 18 to 21 or 4 % ; 26 to 29 or 4%; and 54 to 57 years old or 4%.

Table 7

### *Comparison of the Educational Attainment of Inmates*

Educational Background	Provincial Jail		City Jail	
	Percentage	Rank	Percentage	Rank
Elementary	22	2 <sup>nd</sup>	11	2 <sup>nd</sup>
High School	72	1 <sup>st</sup>	89	1 <sup>st</sup>
College	5	3 <sup>rd</sup>	0	
Post graduate	1	4 <sup>th</sup>	0	

Table 7 shows the Educational Attainment of inmates in Cavite Provincial Jail, it is notable that 72% were High School graduate and 22 % were elementary graduate. This was also true with Trece Martires City Jail with 89% were High School graduate and 11% were elementary graduate. Both Cavite Provincial Jail and Trece Martires City Jail have the low percentage of College graduate.

Table 8

*Comparison of the Length of Detention of Inmates*

Length of Detention	Provincial Jail		City Jail	
	Percentage	Rank	Percentage	Rank
Below 1	40	1 <sup>st</sup>	22	2 <sup>nd</sup>
2 – 3	34	2 <sup>nd</sup>	67	1 <sup>st</sup>
4 – 5	5	4 <sup>th</sup>	2	4 <sup>th</sup>
6-7	19	3 <sup>rd</sup>	4	3 <sup>rd</sup>
Specify	2	5 <sup>th</sup>	4	3 <sup>rd</sup>

Table 8 shows that 40% of inmates were new and lived in Cavite Provincial Jail for less than 1 year followed by those who were in jail from 2 to 3 years; while those who stayed for 4 to 5 years have the smallest interpretation.

Table 9

*Comparison of the Gender of Inmates*

Gender	Provincial Jail		City Jail	
	Percentage	Rank	Percentage	Rank
Female	16	2 <sup>nd</sup>	29	2 <sup>nd</sup>
Male	83	1 <sup>st</sup>	64	1 <sup>st</sup>
Lesbian	1	3 <sup>rd</sup>	4	3 <sup>rd</sup>
Gay	0		0	
Bisexual	0		0	
Transgender	0		0	
Queer	0		0	

Table 9 shows that in Cavite Provincial Jail were mostly male with 83%, 16% female and only 1% Lesbian; while in Trece Martires City Jail, majority of employees were also male with 64%, 29% were female and only 4% were Lesbians.

Table 10

*Comparative Assessment on the Management of Provincial Jail and Trece Martires City Jail as perceived by Inmates*

Categories	Provincial City Jail		City Jail	
	Weighted Mean	Verbal Interpretation	Weighted Mean	Verbal Interpretation
A. Manpower	3.15	Good	3.03	Good
B. Facilities	2.57	Good	2.50	Good
C. Development Program	3.41	Good	3.03	Good
D. Discipline	3.41	Good	3.08	Good
OVERALL	3.14	Good	2.91	Good

*Legend: 3.50 to 4.00 – excellent; 2.50 to 3.49 – good; 1.50 to 2.49 – fair; and 1.00 to 1.49 – poor*

Table 10 shows that Cavite Provincial Jail Category C and D has the highest weighted mean of 3.41 with the verbal interpretation of Good; while in Trece Martires City Jail category D has the highest weighted mean of 3.08 with the verbal representation of good.

Based on z-test of the two independent proportions, there is no significant difference between the perception of the jail officers in terms of the management of their respective offices ( $z = 0.242, 0.01$ ).

## **Conclusion and Recommendation**

Based on the findings, most of the personnel of Cavite Provincial Jail were aged 50- 53 years old; on the other hand personnel from Trece Martires City Jail were between 30 -33 years old. Most of the inmates of Cavite Provincial Jail were from 30 – 33 years old, same with Trece Martires City Jail inmates.

In terms of Educational Attainment, 88% of the Cavite Provincial Jail personnel were college graduate; while 72% of the inmates were high school graduate. On the other hand, all Trece Martires City Jail employees were college graduate while 89% of the inmates were high school graduate.

As for Gender, both employees of Cavite Provincial Jail and Trece Martires City Jail were mostly male as well as their inmates.

In terms of Manpower, both Cavite Provincial Jail and Trece Martires City Jail were interpreted as good.

In terms of Discipline, both Cavite Provincial Jail and Trece Martires have same implementation to the inmates.

In terms of Development Program, both respondents agreed that Cavite Provincial Jail and Trece Martires City Jail implement it well.

In terms of Facilities, personnel and inmates of Cavite Provincial Jail said it is good; on the other hand, Trece Martires City Jail employees interpreted it as fair; while their inmates said it is good.

To provide better security, both Trece Martires City Jail and Cavite Provincial Jail may employ more employees of less than 50 years old for operational services such as escorting, custodial, and control of visitors. These duties require great energy and experience, thus veteran officers still need to mentor the young ones.

Since most of the inmates are facing charges or serving sentence in relation to R.A. No. 9165 or the Comprehensive Dangerous Drug Act of 2002, both jails may adopt and implement program focusing on drug awareness. Programs might include activities and counseling to inform inmates the danger the drug addiction might cause to their health as well as their relationship with their families and friends. Researchers recommend a focus and emphasis on this drug prevention program specifically in terms of demand reduction.

The Trece Martires City Jail may plan for the renovation to provide more services for the reformation and character-building of the inmates. They may also allot more beds and more comfort rooms for male and female residents. The expansion of visitor area as well as the maintenance of its cleanliness especially in Trece Martires City Jail must be given priority for a more comfortable visit of relatives of the inmates. Also, the expansion of classrooms for Livelihood and Vocational Programs and the establishment of clinics for the quarantine and medication of Inmates suffering from contagious diseases are recommended.

To provide better services for the welfare of both Inmates and the management, manning level with a ratio of at least 1:20 might be met by both jails. Towards this end, BJMP may allot more quota in the recruitment. Cavite

Provincial Jail holds more number of inmates than that of Trece Martires City Jail. Also, sentenced inmates are convicted for crimes with penalties ranging from prison term of six (6) months and one (1) day to three (3) years. Considering the standards of recruitment for officers of Provincial Jail from the lowest to the executive level of the hierarchy, the Government is not that strict. College undergraduates may occupy significant positions. In fact, there were seven (7) executives of the Provincial Jail in the research conducted. Further standardization and professionalization may be adopted.

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