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EULOGIO "AMANG" RODRIGUEZ INSTITUTE OF SCIENCE AND TECHNOLOGY

Nagtahan, Sampaloc Manila

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TECHNOLOGY INNOVATION AND SUPPORT OFFICE

Republic of the Philippines
EULOGIO "AMANG" RODRIGUEZ
INSTITUTE OF SCIENCE AND TECHNOLOGY
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Creating Innovative Solutions Towards Modern Life

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FOREWORD

The Eulogio "Amang" Rodriguez Institute of Science and Technology takes pride in publishing Volume XVII, No. 22, July – December 2017 of the EARIST Research Journal as it contributes to the attainment of EARIST's Mission, Vision, Goals, and Objectives through scholarly publications.

This volume is the output of researches conducted by EARIST faculty during the School Year 2016-2017. This volume highlighted eleven (11) distinct researches in different fields, but most noteworthy, each individual research achievement.

The topics vary as shown in every page, but each is full of diverse stories confirming happenings in every college of the Institute. The office of research hopes to mirror the activities of our educators in assuming their task as researchers.

There are more challenges left in the various fields waiting for further scrutiny. We continue the never ending cycle of the quest for new knowledge and further understanding of the issues at hand. The work remains unsolved. But unless we produce our own solutions to existing problems, the challenges will never be met.

The research work undertaken by faculty members and staff are included with the hope that these will contribute to the advancement of research activities of the institute and will serve as medium in the dissemination of research outputs to the community.

Engr. Rogelio T. Mamaradlo
Director, Research Services

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Technical Research

FORMULATION OF AN ORGANIC CHICKEN FEEDS

Nerissa M. de Guzman
Mary Jane J. Gabriel
in collaboration with: Decelyn Solis, Hazel Dima, and Ma. Cristine Joy Tan

INTRODUCTION

The researchers conducted the study in an attempt to contribute to the massive government programs and agenda towards economic recovery through science and technology. Last March 24, 2017, at the Department of Science & Technology Compound, during the forum on Metals and Engineering Research and Developments, Dr. Rowena Cristia C. Guevarra, undersecretary for Research and Development of DOST discussed the composition of their councils namely: Philippine Council for Industry, Energy and Emerging Technology Research and Development, Philippine Council for Health Research and Development, Philippine for Agriculture and Aquatic Resources Research and Development, Industrial Technology and Development Institute and Metals and Industries Research and Development Council. These are the core groups which are helping each other to help the Filipinos toward economic growth and sustainability.

Ms. Lilibeth O. Furoc, on her end, discussed their programs and agenda particularly in agricultural crops and livestock. She insinuated how engineers could possibly help them with their initial studies and current projects. In response to the challenges posted by our farmers, she said that engineers must help them particularly in mechanization and automation systems for crop management and post production.

This study is an attempt to utilize organic materials as feeds that will complement, if not totally replace the existing commercial feeds in the market today.

Commercial feeds have long been in use widely in poultry production. Several disadvantages were already brought about by the practice particularly health issues of commercially raised chickens to human consumption. This may seems odd, but there were some finding that some commercial feeds causes those health issues to chicken upon consumption. Aside from that, they are also more expensive compared to self-formulated organic feeds.

STATEMENT OF THE PROBLEM

The study sought to produce an optimized formulation of an organic feed for poultry raisers using organic plants that may be planted among agricultural crops using Madre de Agua leaves, Flemingia leaves, duckweed, Malunggay leaves, Tilapia fish and snails. The finished product is expected to supply sufficient nutrients for chicken and ducks which could be consumed by humans.

SIGNIFICANCE OF THE STUDY

The study sought to contribute to the following:

Future Researchers. This study could serve as a guide so that more development can be sustained in the feed industries.

Farmers and Poultry Raisers. They could benefit from this study if their livestock can be sold in its maximum worth.

The People. They could benefit from it if they could have another option where to buy poultry products at a lower costs.

The country could benefit in terms of income generation and more active labor supply.

RELATED LITERATURE AND STUDIES

Equipment for Making Your Own Poultry Feed

Making your own feed for more than a handful of chickens requires a commercial, heavy-duty feed or flour mill. This way you can freshly grind the grains you purchase for your hens.

You will also need to think about storage for the bags of grains you buy. Consider building a storage bin with partitions for each of your grains and a lid at the top. If you can use a sliding gate at the bottom to dispense the grain, you can naturally rotate the grains. You may need to clean the bins out completely once or twice a year to prevent pests from infesting them.

What to Put in Your DIY Poultry Feed

Whether you grow some, all or none of it, the key question is: what plants should you feed them? In what proportions? If you search the Internet you will find many different recipes. In some ways, you're going to have to customize your feed to the specifics of your geographical region: what's available, what's inexpensive, and what you can grow if you plan to grow it yourself will all factor in to the final feed.

You will want to study the ingredients in commercial poultry feed to see what percentages you are shooting for. If you are a little lower in protein than commercial brands, that's okay - just be aware that your birds will not grow as quickly. You do need to make sure that you strike a balance of all the macronutrients, like fats, carbohydrates and protein, and micronutrients such as vitamins and enzymes. Some trial and error might come into play.

Here are some of the ingredients you should consider putting in your chicken feed. Please remember this is just a general guideline. You'll need to research this more thoroughly and put together your own custom mix.

Main Feed:

- Alfalfa meal (high protein, good for winter)
- Corn (mainstay for chickens, store whole)
- Field peas (for protein, to avoid soybean use)
- Wheat
- Oats and/or Barley (less than 15% of total diet together)

Things to Add:

- Aragonite or feeding limestone (for calcium, not entirely needed)
- Oyster shell (calcium, free feed)

- Grit
- Salt
- Probiotic (or feed them fermented dairy foods like kefir or yogurt, or fermented vegetables like sauerkraut)
- Crab meal (small amounts provide protein and minerals)
- Flax seed (omega-3, feed whole to avoid rancidity)
- Broad-spectrum mineral supplement
- Kelp (mineral source)
- Fish meal (helps boost protein and omega-3s)
- Cultured yeast (B vitamins, minerals and digestive enzymes)

Feed Needed at a Chicken's Different Stages of Growth

For the most part, chicks from 28 days of age and up are fed a "starter ration." This ration contains high levels of protein (approximately 22 percent) to give the chicks the energy they need to grow and develop properly. From eight weeks of age and up to when they start laying (usually around six months of age), the pullets are fed a grower ration containing about 17 percent protein. Once laying commences, layer ration is fed to them.

Nutritional Composition Required by Chickens in Their Food

Some of the minerals needed in general chicken feed are zinc, copper, iodine, magnesium, calcium, sodium (0.15%, also equal to 0.37% sodium chloride), phosphorus, potassium, manganese, and iron. Some of the vitamins needed by chickens that must be in their feed are Vitamin E, Vitamin D, Vitamin A, Vitamin K, Thiamine, Niacin, Pyridoxine, Riboflavin, Pantothenic acid, biotin, Vitamin B12, choline and folacin.

When formulating and mixing your own backyard chicken feed, the following method will help you determine the amount of energy and protein ingredients needed in the feed. The Electronic Cigarette equation is called the "Dairyman's Square."

1. Draw a square

2. In the center of the square, write the protein content desired in the final mixture (such as 20%)

3. At the upper LEFT hand corner write "corn" and its protein content (9%)

4. At the lower LEFT hand corner, write "supplement" and its protein content (40%)

5. Subtract diagonally across the square (the smaller from the larger) and enter (in the corners) the results on the RIGHT hand side (20-9=11; 40-20=20)

6. The number at the upper RIGHT hand corner gives the parts of corn, and in the lower RIGHT hand corner you have the parts of supplement needed to make a mixture with 20 percent protein. Thus, 20 parts of corn mixed with 11 parts of supplement gives 31 parts of feed with 20 percent protein.

7. To convert this to a percentage basis, divide 20 by 31 and multiply the result by 100. The ending result, 64.5 percent, indicated the amount of corn that will be used. The supplement is represented by the remaining percent (35.5). And so…in a 100 pound 20 percent mix, there would be 64.5 pounds of corn and 35.5 pounds of supplement.

The above is one of the simpler ways to compute and balance a poultry ration. Commercial feeds will have the required amounts of nutrients and minerals and proteins, but if you're mixing your own rations, use the Dairyman's Square to figure out how much you need of each ingredient.

Feed ingredients for poultry diets are selected for the nutrients they can provide, the absence of anti-nutritional or toxic factors, their palatability or effect on voluntary feed intake, and their cost. The key nutrients that need to be supplied by the dietary ingredients are amino acids contained in proteins, vitamins and minerals. All life functions also require energy, obtained from starches, lipids and proteins. Feed ingredients are broadly classified into cereal grains, protein meals, fats and oils, minerals, feed additives, and miscellaneous raw materials, such as roots and tubers. These will be discussed in separate headings below. More information on measuring the nutrient composition of ingredients and the process of formulating poultry feeds is available in the section on feed formulation.

Cereal grains

The term "cereal gains" here includes cereal grains, cereal by-products and distillers dry grains with solubles (DDGS). Cereal grains are used mainly to satisfy the energy requirement of poultry. The dominant feed grain is corn, although different grains are used in various countries and regions of the world. For instance, in the US, Brazil and most Asian countries corn is by far the most important energy source for all poultry feed, whereas wheat is the predominant supplier of dietary energy for poultry diets in Europe, Canada, Australia, New Zealand and the Russian Federation. Of course, in reality, a feed manufacturer will use any grain in a poultry diet if it is available at a reasonable price. For instance, in some parts of the US and China wheat is often used in place of corn if its price is below that of corn. In Australia, sorghum is a key grain during the summer season instead of wheat, while in the Scandinavian countries barley and rye are used when these grains are at the right price. Although the amounts and types of cereal grains included in poultry diets will depend largely on their current costs relative to their nutritive values, care must be taken to avoid making large changes to the cereal component of diets as sudden changes can cause digestive upsets that may reduce productivity and predispose the birds to disease.

Table 1. ME values and Nutrient composition of cereal grains protein sources

Ingredient	Protein (%)	ME (kcal/kg)	Calcium (%)	Available P (%)	Lysine (%)
Wheat	13.0	3153	0.05	0.20	0.5
Sorghum	9.0	3263	0.02	0.15	0.3
Barley	11.5	2795	0.10	0.20	0.4
Rye	12.5	2734	0.05	0.18	0.5
Triticale	15.4	3110	0.05	0.19	0.4
Oats	12.0	2756	0.10	0.20	0.4

The quality of cereal grains will also depend on seasonal and storage conditions. Poor growing or storage conditions can lead to grains with a lower than expected energy content or contamination with mycotoxins or toxin-producing organisms such as fungi and ergots. Genetic and environmental factors also affect not only the content of nutrients in grains but also the nutritive value, which takes into account the digestibility of nutrients contained in an ingredient in the target animal.

In addition to the cereals themselves, their by-products, such as wheat bran, rice bran and DDGS, are used widely in poultry feed. Cereal by-products are typically high in fibre, or non-starch polysaccharides (NSP), which are poorly utilised in poultry and are low in ME.

Protein meals

Protein is provided from both vegetable and animal sources, such as oilseed meals, legumes and abattoir and fish processing by-products.

Vegetable protein sources

Vegetable protein sources usually come as meal or cake, the by-product of oilseed crops. The main oilseed crops include soybean, rapeseed/canola, sunflower, palm kernel, copra, linseed peanut and sesame seed. After the oil is extracted, the remaining residue is used as feed ingredient. Oilseed meals make up 20-25% of a poultry diet. Inclusion levels do vary among formulations for different species and for the same species in different regions. The main vegetable protein sources used in Australian poultry diets are soybean and canola. Other sources like cottonseed, sunflower, peas and lupins may be included in poultry feed formulations if these are available at a reasonable price.

Many oilseeds and legumes contain anti-nutritive factors. Some of these anti-nutritive factors can be destroyed by heat and are used in heat-treated meals. New cultivars of some oilseeds and legumes have been developed that are naturally low in anti-nutritive factors, permitting higher levels of the unprocessed grains to be included in poultry diets without ill-effect. The typical energy values and nutrient composition of vegetable protein sources are shown in Table 2.

Table 2. ME values and Nutrient composition of vegetable protein sources

Ingredient	Protein (%)	ME (kcal/kg)	Calcium (%)	Available P (%)	Lysine (%)
Soybean meal	48.0	2557	0.20	0.37	3.2
Canola meal	37.5	2000	0.66	0.47	2.2
Cottonseed meal	41.0	2350	0.15	0.48	1.7
Sunflower meal	46.8	2205	0.30	0.50	1.6
Peas	23.5	2550	0.10	0.20	1.6
Lupins	34.5	3000	0.20	0.20	1.7

Animal protein sources

The main animal protein sources used in poultry diets are meat meal, meat and bone meal, fish meal, poultry by-product meal, blood meal and feather meal. Although the production of animal protein for human consumption has been under continual pressure and marred by much controversy, the world-wide and domestic consumption of animal protein continues to grow and much of the future supply of meat protein will come from poultry. With increased animal protein production there will be increased demand for feed and, in particular, a demand for ingredients high in protein and energy.

The animal industry evolved as a means of adding value (i.e. higher nutrient level and availability, flavour, variety, etc.) to ingredients that were of marginal food value for humans. These ingredients include grains that are of poor quality or damaged by harvest or storage conditions; as well as a means of recycling by-products of brewing, vegetable oil, meat, milk and egg production. Approximately 50% of the live market weight of ruminants and 30% of poultry is by-product. These by-products are rendered, ground and available as a feed source.

Animal protein meals are usually defined by inputs. Those specifically used in poultry diets include meat (no bone) or meat and bone meal from ruminants and/or swine; blood meal; poultry by-product meal; feather meal; and fish meal. There are specific limitations now assigned to these products with regards to inputs used and guarantees with respect to minimum nutrient levels. For example meat and bone meal may be specifically from ruminants and must be free of hair, wool and hide trimmings, except where it is naturally adhering to heads and hoofs. The products are rendered, which is a biosecure process that evaporates water, extracts fat and yields a finished ground product high in protein (which has no resemblance to the raw product) and minerals. The products are marketed with guarantees as to minimum protein, phosphorus and calcium levels.

There are some challenges associated with the use of animal protein sources. First, food safety is the most important concern people have about the recycling of animal protein meals back through animals as feed ingredients. This is based on the links between the prion disease bovine spongiform encephalopathy (BSE – mad cow disease) and a variant Creutzfeldt-Jakob disease in humans. Importantly for poultry production though, researchers have been unable to demonstrate the transfer of prions to poultry (Moore J *et.al.* (2011) BMC Res Notes. Vol.4, p.501) and no symptoms of disease have been observed in birds up to five years after direct challenges. The proteins (prions) associated with BSE are not destroyed by traditional methods of rendering and are capable of causing disease when BSE contaminated meat and bone meals are injected cerebrally into ruminants.

As a consequence of the public's concerns about BSE, Australia does not allow the use of ruminant by-products in feed for ruminants; however, ruminant by-products are available for use in poultry feed.

In addition to BSE contamination, there are concerns that animal protein meals are responsible for food borne pathogen contamination, such as Salmonella. Typically these bacteria are destroyed by rendering and possible recontamination is often negated by pelleting of manufactured feeds. In most cases, if poultry acquire Salmonella it is likely to be from an environmental source other than feed. It is possible for animal protein meals to be contaminated with high levels of heavy metals, dioxins and PCBs (pesticides); however, meals are monitored and regulated to minimise this contamination.

Secondly, with respect to feeding the animal protein meals, the important practical issue is the variability in available nutrients (those that can be absorbed and retained by the bird) and limits to incorporation to maintain a diet balanced for all nutrients, particularly calcium and phosphorus. Table 3 shows the determined averages that are used in determining nutrient levels for meat and bone, blood, feather and poultry meals.

Table 3. ME values Nutrient levels in selected animal protein meals

Nutrient	Meat & Bone	Blood	Feather	Poultry
ME (MJ/kg)	11.2	15.2	13.7	13.1
Protein (%)	50.4	88.9	81.0	60.0
Fat (%)	10.0	1.0	7.0	13.0
Calcium (%)	10.3	0.4	0.3	3.0
Phosphorus (%)	5.1	0.3	0.5	1.7
Lysine (%)	2.6	7.1	2.3	3.1
Methionine (%)	0.7	0.6	0.6	1.0
Cystine (%)	0.7	0.5	4.3	1.0

Source: adapted from Hamilton (2002)

Animal protein meals provide a good source of essential amino acids (e.g. lysine and methionine) and are also good sources of energy and minerals (particularly calcium and available phosphorus). However, there can be significant variation in availability (absorption and retention) of amino acids due to the day to day variation in inputs as well as processing conditions (temperature, moisture, pressure and time). The variation within processing plants can often be greater than variation between plants. It is important for users to establish strict criteria as to the quality of product and work with their suppliers to ensure these criteria are met. Quality should include measurements that indicate moisture; nutrient availability (particularly essential amino acids); levels of minerals (for example, calcium can vary from 8–12%; phosphorus from 4–6%); and stability of fat (all meals should be stabilised with an antioxidant).

The most accurate way of measuring the 'feed value' of an ingredient is to use an animal assay or bioassay. However, these assays are extremely time consuming and expensive. One of the most promising predictors of nutrient level and availability is near-infrared reflectance spectroscopy. This technology is rapidly being adopted by feed manufacturers and enables rapid screening of incoming products for a wide variety of measurements (moisture, protein, amino acid availability, fat, etc.). In most cases the samples can be prepared, scanned and results assessed in a few minutes. However, calibrations are still being established for meals and further research is required to classify the cause of variation in feed value.

Animal protein meals have a long history in poultry nutrition. Utilisation of this valuable feed ingredient is important in minimising loss (nutrient and economic value) in the production of safe, high quality poultry meat, eggs and bioproducts.

The typical ME values and nutrient composition of common animal protein sources are shown in Table 4.

Table 4. ME values and nutrient composition of selected animal protein sources

Ingredient	Protein (%)	ME (kcal/kg)	Calcium (%)	Available P (%)	Lysine (%)
Meat meal	50.0	2500	8.00	4.00	3.6
Fish meal	60.0	2720	6.50	3.50	5.3
Poultry by-product meal	60.0	2950	3.50	2.10	3.4
Blood meal	80.0	2690	0.28	0.28	6.9
Feather meal	85.0	3016	0.20	0.75	1.7

Fats and oils

Fats and oils, collectedly termed lipids, are regularly used in poultry feed to satisfy the energy need of the animal as lipids have more than twice the amount of ME compared with carbohydrates or proteins per kg weight. Lipids are also an important carrier for fat soluble vitamins (A, D, E, and K) as wells for the provision of an essential fatty acid, linoleic acid, in the diet. A variety of fats and oils are used in feed, including lipids of animal origins (usually fats, i.e., tallow, lard, except fish oil) and lipids of vegetable origin (usually oils, i.e., soy oil, canola/rapeseed oil, sunflower oil, linseed oil, palm oil, cottonseed oil).

In practical feed formulation, the level of lipids rarely exceeds 4% in compound feed. However, even a small decrease in digestibility can cost dearly in terms of dietary energy. Like any other nutrient, a varying proportion of lipids are undigested depending on their sources and

the species and age of the animal to which they are fed. Some of the data are summarized in Table 5.

Table 5. Lipid source and bird age on total tract digestibility of lipids

Lipid source	Digestibility (%)	Bird age (week)	Digestibility (%)
Tallow	73.6	1	53.2
Soy oil	85.0	2	80.7
Tallow-soy blend	75.4	3	85.9
Poultry fat	82.1	5	85.7
Palm oil	77.2	Average	76.4

Tancharoenrat 2012

It is surprising that nearly a quarter of dietary lipids are lost in the excreta of chickens. The significance of this can be seen from the fact that even with a seemingly small amount of inclusion, say 2.5% added fat in feed, it contributes as much as 7-9% of the dietary energy of a typical poultry diet. Thus, any improvement in digestibility, which may be achieved via the use of appropriate additives, such as enzymes, acidifiers and emulsifiers, will have a significant impact on the energy content of diets.

Minerals and vitamins

Minerals are vital for normal growth and development in poultry, such as bone formation and body processes such as enzyme activation. Some minerals such calcium and phosphorus are required in large quantities. For example, laying hens require between 3.5-4% calcium, 0.3-0.4% available phosphorus and 0.2% sodium in their diets for egg production. Other minerals, such as copper, iron, manganese, zinc, selenium, cobalt, iodine and molybdenum, are required in milligram quantities but deficiency of these minerals will lead to serious health problems in mild cases and death in severe cases.

Similarly, vitamins are essential for the body systems of poultry. Both fat soluble (A, D, E, K) and water soluble (biotin, choline, folic acid, niacin, riboflavin, thiamine, pyridoxine, pantothenic acid and B12) are needed in the diet to maintain proper health and wellbeing of poultry.

Duckweed - a potential high-protein feed resource for domestic animals and fish

R A Leng, J H Stambolie and R Bell. Centre for Duckweed Research & Development University of New England Armidale, NSW 2351.

SUMMARY

Duckweeds have received research attention because of their great potential to remove mineral contaminants from waste waters emanating from sewage works, intensive animal industries or from intensive irrigated crop production. Duckweeds need to be managed, protected from wind, maintained at an optimum density by judicious and regular harvesting and fertilized to balance nutrient concentrations in water to obtain optimal growth rates. When effectively managed in this way duckweeds yield 10-30 ton DM/ha/year containing up to 43% crude protein, 5% lipids and a highly digestible dry matter.

Duckweeds have been fed to animals and fish to complement diets, largely to provide a protein of high biological value. Fish production can be stimulated by feeding duckweed to the extent that yields can be increased from a few hundred kilograms per hectare/year to 10 tons/ha./year.

Mature poultry can utilize duckweed as a substitute for vegetable protein in cereal grain based diets whereas very young chickens suffered a small weight gain reduction by such substitution. Pigs can use duckweed as a protein/energy source with slightly less efficiency than soya bean meal.

Little work has been done on duckweed meals as supplements to forages given to ruminants, but there appears to be considerable scope for its use as a mineral (particularly P) and N source. The protein of duckweeds requires treatment to protect it from microbial degradation in the rumen in order to provide protein directly to the animal.

The combination of crop residues and fresh duckweeds in a diet for ruminants appears to provide a balance of nutrients capable of optimizing rumen microbial fermentative capacity. These diets can, therefore, be potentially exploited in cattle, sheep and goat production systems particularly by small farmers in tropical developing countries.

KEY WORDS: Duckweeds, Lemna spp, cultivation, composition, fish, livestock, nutrition

The plant and its habitat

Duckweed species are small floating aquatic plants found worldwide and often seen growing in thick, blanket-like mats on still or slow moving, nutrient-rich fresh or brackish waters. They are monocotyledons of the botanical family Lemnaceae and are higher plants or macrophytes, although they are often mistaken for algae.

Duckweeds grow at water temperatures between 6 and 33°C. Many species of duckweed cope with low temperatures by forming a turion and the plant sinks to the bottom of a lagoon where it remains dormant until warmer water brings about a resumption of normal growth.

Duckweeds have structural features that have been simplified by natural selection. A duckweed leaf is flat and ovoid. Many species have adventitious roots which function as a stability organ and which tend to lengthen as mineral nutrients in water are exhausted.

Compared with most plants, duckweed leaves have little fiber (5% in dry matter of cultivated plants) as they do not need to support upright structures. Roots, however, appear to be more fibrous. As a result the plant has little or no indigestible material even for monogastric animals. This contrasts with many crops such as soya beans, rice, or maize, where approximately 50% of the biomass is in the form of high fiber, low digestibility residues.

Duckweed species are adapted to a wide variety of geographic and climatic zones. They are found in all but waterless deserts and permanently frozen areas. They grow best in tropical and temperate zones and many species can survive temperature extremes.

The natural habitat of duckweed is the surface of fresh or brackish water which is sheltered from wind and wave action. They do not survive in fast moving water (>0.3 m/second) or water unsheltered from wind which is an important attribute as they do not become weeds in water ways.

The best nutritional situations for duckweed growth are in waters with decaying organic material, providing it with a steady supply of nutrients. A dense cover of duckweed inhibits competing submerged aquatic plants, which require solar energy for growth and they can also often exclude algae from bodies of water.

Growing duckweed and its nutritive value

The best conditions for cultivation of duckweed simulates the favored natural environmental niche, namely a sheltered lagoon or a lagoon with surface partitions to prevent wind from blowing the plants onto the banks causing conditions of self-shading and competition for nutrients. For high growth rates, nutrients must be made available, at a rate commensurate with growth, being derived either from organic or mineral fertilizers added daily.

Duckweed reproduction is primarily vegetative. An individual leaf may go through 10 divisions over a period of 10 days to several weeks before the original plant senesces. Duckweeds can double their mass in between 16 hours to 2 days under optimal nutrient availability, sunlight, and water temperature. This is faster than almost any other higher plant. Under experimental conditions their production rate can approach an extrapolated 183 metric tons/ha./year of dry matter although yields are closer to 10-20 tons of DM/ha/year under real-world conditions (Table 1).

The growth pattern resembles the exponential growth of unicellular algae more than that of higher plants and this confers a high potential for production as a livestock feed resource.

Table 1. Some reported yields of duckweed dry matter under a variety of growth conditions

Location	DM Yield (tonnes/ha/yr)	Source
SUB OPTIMUM ENVIRONMENT		
Thailand	10-11	Hassan and Edwards (1992),
		Landolt & Kandeler (1987)
Israel	10-17	Porath et al (1979)
Russia	7-8	Landolt and Kandeler (1987)
Uzbekistan	7-15	Landolt and Kandeler (1987)
Germany	16-22	Landolt and Kandeler (1987)
India	22	Landolt and Kandeler (1987)
Egypt	10	Landolt and Kandeler (1987)
Southern States - USA	2-23	Culley and Epps (1973),
		Rusoff et al (1980),
		Reddy and DeBusk (1985),
		Landolt and Kandeler (1987)
NEAR OPTIMUM ENVIRONMENT		
Southern States - USA	27-79	Mestayer et al (1984)
Israel	36-51	Oran et al (1987)

Growth rates of duckweed colonies will be reduced by a variety of stresses: such as nutrient scarcity or imbalance; toxins; extremes of pH and temperature; crowding by overgrowth of the colony and competition from other plants for light and nutrients. However, when conditions are good, duckweed contains considerable protein, fat, starch and minerals which appear to be mobilized for biomass growth when nutrient concentrations fall below critical levels for growth. The reported nutrient densities in duckweed therefore vary according to conditions of growth (Table 2).

Fresh duckweed contains about 92-94% water. Fiber and ash content are higher and protein content is lower in duckweed colonies that grow slowly.

The concentration of nutrients in dry matter of a wild colony of duckweed growing on nutrient-poor water typically is 15 to 25% protein and 15 to 30% fiber.

Duckweed grown under ideal conditions and harvested regularly will have (in dry matter) a fiber content of 5 to 15%, a crude protein content of 35 to 43%, and a polyunsaturated fat content of about 5%, depending on the species involved (Table 2).

Table 2. Nutrient contents of duckweed harvested in Armidale (Stambolie and Leng 1994)

	N*.25	Fat	Fibre	Ash
	----------% in DM----------			
Natural lagoon	15-35	4.4	8-25	15
Grown on Armidale sewage	40-43	5.4	5	13

Growth conditions

Unlike most plants, duckweed tolerates relatively high concentrations of salts (up to 4000 mg/liter total dissolved solids). Nutrients are absorbed through all surfaces of the duckweed leaf.

There are at least three methods of fertilizer application including broadcasting, dissolving in the water column of the plot, and spraying a fertilizer solution on the duckweed mat. Efficient crop management strategies need to maximize fertilizer uptake and at the same time minimize fertilizer losses, particularly nitrogen, while also maintaining the pH of the water in the range of 6-8.

Duckweed survives from pH 5 to 9, but grows best over the pH 6.5 to 7.5 range. Ammonia, in the ionized form is the preferred N substrate for duckweed. An alkaline pH shifts the ammonium-ammonia balance toward the un-ionized state and results in the liberation of free ammonia which is toxic to duckweed at high concentrations (>100 mg NH3/liter).

As a generalization, duckweed growth is controlled by temperature and sunlight more than nutrient concentrations in the water. At high temperatures, duckweeds can grow rapidly down to trace levels of P and N nutrients in water.

The nitrogen content, however, seems to increase over the range from trace ammonia concentrations to 7-12 mg N/liter when the N x 6.25 is maximized at around 40% (see Table 3). Urea is a suitable fertilizer which is rapidly converted to ammonia under normal conditions.

Table 3. The influence of the concentration of N in culture water on crude protein in duckweed (Spirodela spp) grown on diluted effluent from a piggery. The P levels varied from 0.2-6.1 mg P/liter (Leng et al 1994)

N in water (mg/litre)	Total samples	N*6.25 (% in DM)				
		5-20	20-25	25-30	30-35	35-40
		Number in each N*6.25 range				
0-5	7	3	3			
5-10	13	3	4	3	3	2
10-15	12		2	2	2	6
15-20	3					3
20-25	2				1	1
25-30	2					2
30-35	0					
35-40	0					
40-45	2					2

Fast growing duckweed on nutrient-rich water is a highly efficient sink for both phosphorus and potassium, but little of each is required for rapid growth. Muriate of potash and superphosphate are commercial sources of potassium and phosphorus that are widely available in most countries and have been used where duckweed has been farmed. Duckweed growth is not particularly sensitive to potassium or phosphorus once an adequate threshold has been reached. The effect of water phosphorus content on duckweed phosphorus concentration is shown in Table 4. Thus duckweed efficiently concentrates P and could be an important source of P particularly for grazing ruminants in the tropics where P- deficiency is widespread. Duckweeds concentrated P up to 9 mg P/g duckweed DM in the studies reported in the literature. However, recent research showed that levels of up to 1.4 mg P/g duckweed DM have been recorded (Stambolie and Leng, 1994, Figure 2).

Table 4. The relationship between the quantity of P in duckweed and the concentration of P in water. Values below 1.5 mg P/liter of water are Sutton and Ornes (1975); the higher values are from research in this Centre (Stambolie and Leng 1994)

P in water (mg/liter)	Total sample	P (mg/g DM)						
		0-2	2-4	4-6	6-8	8-10	10-12	12-14
		Number in each P range						
0-0.5	6	3	3					
0.5-1.0	1	0	0	1				
1.0-1.5	2	0	0	0	0	1	0	2
1.5-2.0	2	0	0	0	0	0	0	2
2.0-2.5	3	0	0	0	0	1	0	2
2.3-3.0	1	0	0	0	0	0	0	1

Trace mineral requirements for duckweed growth are unknown although it appears the plant is able to concentrate some trace minerals more than 500,000 times. Sea salt has been regarded as a good source of trace minerals to use in duckweed farming. In work in these laboratories, molasses which is a concentrated plant juice has been used to safe guard the trace mineral requirements of duckweed.

Management systems for duckweed

Duckweed species are able to survive extremely adverse conditions. Their growth rate is, however, highly sensitive to the major nutrient balances in the water. They can survive and

recover from extremes of temperature, nutrient loadings, nutrient balance, and pH. However, for duckweed to thrive, these four factors need to be balanced and maintained within reasonable limits.

Crop management and therefore the initial research requirements are concerned with when to fertilize, harvest, and buffer; how much to fertilize and to harvest; and which nutrients to supply. Judicious management should be aimed at: (i) maintaining a complete and dense cover of duckweed; (ii) low dissolved oxygen; and (iii) a pH of 6- 7. A total crop cover suppresses algal growth, which minimizes CO2production from algal respiration and prevents its elevating effect on pH.

Any waste organic material can be used to supply duckweed with nutrients. The most economical sources are wastewater effluents from homes, food processing plants, cattle feedlots, and intensive pig and poultry production. Solid materials, such as manure from livestock, night soil from villages, or food processing wastes, can also be mixed with water and added to a pond at suitable levels. All wastewater containing manure or night soil must undergo an initial treatment by holding it for a few days in an anaerobic pond, before using it to cultivate duckweed. There is an additional need when using such sources of nutrients to reduce solids and prevent the formation of a floating mat.

Duckweed-based wastewater treatment systems

The basic concept of a duckweed wastewater treatment system is to farm local duckweeds on the wastewater which needs to be treated. The rapidly growing plants act as a nutrient sink, absorbing primarily nitrogen, phosphorus, calcium, sodium, potassium, magnesium, carbon and chloride from the wastewater. These ions are then removed permanently from the effluent stream following the harvesting of a proportion of the crop. Depending on the wastewater, the harvested crop may serve as: (i) an animal feed; (ii) feed supplement supplying protein and minerals; or (iii) fertilizer. However, it may have to be decontaminated prior to feeding to animals if heavy metals are present in the water as these are concentrated by the duckweed.

Maintenance of efficient duckweed growth requires an even distribution of a thick layer of plants across the entire lagoon surface. Initial research has shown that there is a range of plant densities that supports optimum growth rate for prevailing conditions. In this case harvesting to maintain approximately 1kg duckweed wet weight per m2 resulted in an extrapolated average yield of 32 tons DM/ha./year. The upper density appears to be that at which crowding limits growth (above 1.2 kg wet weight/m2) and the lower density (<0.6 kg wet weight/m2) is when growth is insufficient to prevent algal blooms.

Using duckweed as a feed/supplement

The composition of duckweed depends on the nutrient content of the water and the prevailing climatic conditions. A range of values for the composition of duckweed is shown in Table 2. Harvested duckweed plants contain up to 43% protein on a dry weight and may be used without further processing as a complete feed for fish.

Duckweed protein has a better array of essential amino acids than most vegetable proteins and more closely resembles animal protein (Hillman and Culley 1978). It is, therefore, a source of high quality protein to be exploited for domestic animal production. Duckweed grown on nutrient-rich water has a high concentration of trace minerals, K and P and pigments, particularly carotene and xanthophyll, that make duckweed meal an especially valuable

supplement for poultry and other animals, and it provides a rich source of vitamins A and B for humans.

Use of duckweed in fish nutrition

A major limitation to fish farming is that meals high in protein with high biological value are expensive and often locally unavailable. Duckweeds grown on water with 10-30 mg NH3-N/liter have a high protein content (around 40%) of high biological value (Hillman and Cully 1978; see Table 2). Fresh duckweed is highly suited to intensive fish farming systems with relatively rapid water exchange for waste removal (Gaigher et al 1984) and duckweed is converted efficiently to live weight by certain fish including carp and tilapia (Hepher and Pruginin 1979; Robinette et al 1980; Van Dyke and Sutton 1977; Hassan and Edwards 1992).

A tilapia culture strategy investigated under a World Bank project in Bangladesh was as follows:

A duckweed lagoon with a standing crop of duckweed is harvested and placed fresh into a second lagoon containing a mixed size tilapia culture. The pond is harvested twice weekly and the fish sorted into various groups for return to the lagoon or sale. Under these circumstances the average yield of fish per hectare of lagoon is estimated at around 10 tons annually using only duckweed as the supplement to the naturally available fish feed (Skillicorn et al 1993).

In recent more detailed studies in Thailand, Hassan and Edwards (1992) have grown tilapia in static-water concrete tanks and fed them on two species of duckweed, Lemna perpusilla and Spirodela polyrrhizaat levels of 0, 25, 50 or 75g duckweed DM per kg wet weight of fish. The duckweeds were relatively low in protein (approx 24% CP). The Spirodela was poorly consumed whereas Lemna was rapidly ingested by fish. The growth rate and feed conversion rates for Lemna-fed tilapia are shown in Table 5.

Table 5. The effects of feeding tilapia increasing levels of duckweed. Tilapias were held in static water in concrete tanks (Hassan and Edwards 1992). The fish initially weighed approximately 41g

Feeding rate Lemna (g DM/kg fish)	Survival rate of fish (%)	Mean LW gain (g/d)	Conversion of Lemna DM to fish live-weight (g/g)
10	97	0.2	1.9
20	100	0.4	1.9
30	100	1.0	1.6
40	60	1.0	2.3
50	27	0.7	3.3
60	17	0.8	3.3

Duckweed is a convenient feed for fish. Its attributes are:

- It can be readily grown locally often in waste ponds that are polluted.
- It can be fed fresh and since it floats, by judicious setting of the rates of application it may be totally used by fish.
- It is used very efficiently by fish such as tilapia and carp but other species might well cope with duckweed as a component of the diet since it is particularly low in fibre and high in protein when grown under ideal conditions.

- It is relatively inexpensive to produce or may be regarded to have no cost where the opportunity costs of family labour are not taken into consideration.

Use of duckweed in pig and poultry production

It seems reasonable to assume that village pigs, horses or ruminants could be fed on freshly harvested duckweed. For most applications with poultry, dried duckweed would be preferable. Research with ducks has been surprisingly lacking but it could be expected that duckweed would provide an ideal wet supplement to any high energy diet.

Research on using duckweed in the diets of domestic animals has been surprisingly scarce, perhaps because of the difficulties of growing sufficient duckweed under experimental conditions. However, with knowledge of how to grow duckweed efficiently; that is the levels of minerals in water that are needed, how often to harvest and the density that must be retained in the residual crop -- a yield of 10-20 tons dry matter/ha/year containing say 40% protein can be reasonably and easily achieved. Thus there are major opportunities to grow duckweed as a crop for animal production purposes, but research on preparation and drying is needed to facilitate the uptake of the technology particularly in the poultry industry.

Poultry nutrition studies

The potential nutritional value of duckweed in poultry diets has long been recognized (Lautner and Mueller 1954; Musaffarov 1968; Abdullaev 1969). Dehydrated duckweed has been used to replace alfalfa (lucerne) meal as a protein source in conventional poultry diets. Chickens fed 10% dehydrated duckweed had superior weight gains to those fed conventional protein sources. However, variable responses are often reported depending on the source of the duckweed which can be high protein/low fiber or low protein/high fiber depending on the nutrients in the growth medium.

Layer performance and egg quality in birds fed Lemna meal (from sewage water) at levels of 0, 25 and 40% inclusion in a conventional ration are shown in Table 6.

Table 6. Production levels of egg-laying birds at 18 weeks on conventional base diet containing varying proportions of dehydrated Lemna gibba meal (33% N x 6.25 in DM). Metabolizable energy and protein intake were consistent across treatments (Haustein et al 1988)

	Level of dehydrated duckweed, %		
	0	**25**	**40**
Feed consumption (g/d)	131	131	125
No of eggs/ week/ hen	5.9	5.9	5.6
Mean egg wt (g)	64.2	63.1	63.6
Feed conversion (g DM/g egg)	2.41	2.47	2.38
Live weight gain (g)	40	114	-118

Recent studies have demonstrated that the growth of very young broiler chickens may be retarded with increasing levels of Lemna gibba dehydrated meal in the diet (Haustein et al 1992b) whereas layer hens produced effectively (Haustein et al 1990a) and older broiler birds had excellent growth when fed relatively high levels of Lemna gibba meal. Thus there is a need to be conservative when using Lemna protein meals with young birds.

Undoubtedly duckweed can replace conventional protein and energy sources in chicken diets up to 25% of the total dry matter without jeopardizing a high level of production. This indicates that duckweed of known chemical analysis can be used in least-cost ration formulation for both poultry meat and egg production.

Pig nutrition

Little work appears to have been done on the feeding of duckweed to pigs perhaps because of the difficulties under experimental conditions of obtaining sufficient meal for such studies. Research with a low protein/high fiber duckweed meal (23% N x 6.25 and 7.5% fiber in DM) showed that replacing conventional protein sources in diets for growing pigs reduced production and increased feed required per unit growth (Haustein et al 1992a). Growth rates of pigs on different levels of duckweed meal are shown in Table 7.

Table 7: The live weight of pigs fed three levels of Lemna meal to replace a conventional protein meal in a cereal-based diet balanced to the same protein/energy intake (Haustein et al 1992a)

Time (days)	Level of Lemna meal in diet (%)		
	0	5	10
	(Live weight, kg)		
1	6.9	6.8	6.8
10	9.4	9.2	9.1
20	13.4	11.9	11.2
30	17.4	14.6	13.2
40	23.8	19.5	17.2

Further research is needed to show how duckweed can be used as the protein source in diets for pigs. Studies using wet and dry duckweed and conventional (grain-based) or non-conventional feeds (eg: sugar cane juice or molasses) are urgently needed. If systems based on non-conventional feeds were to be successful they would support small farm enterprises of great significance (see Preston and Murgueitio 1992).

Ruminant nutrition

Very little literature is available on the utilization of duckweeds by ruminants. Duckweeds grown on nutrient-rich waters have the potential to be of high nutritional value particularly for the young or lactating ruminant and preliminary observations suggest that they might form the basis of a supplement to diets based on mature biomass such as crop residues, mature grass or pasture. Even the high water content, softening the straw, let alone the nutrients they provide would facilitate the use of straw by ruminants.

However, unlike the case for monogastric nutrition where feed analyses are indicative of nutrient availability to the animal, the compounding of diets for ruminants needs to take into account microbial activity in the rumen which can alter the availability of nutrients from duckweed when consumed and digested. Ruminants fed mature biomass such as straw are generally deficient in a range of minerals and ammonia for efficient fermentative digestion of the straw in the rumen and in addition for maximum efficiency of feed utilization they require supplements containing proteins that escape the rumen environment to be digested in the intestines.

With ruminants, therefore, it is necessary to describe the nutritional role that is required of the duckweed before assessing its feeding value. There are some preliminary attempts to use duckweed as a supplement to ruminant diets, however, there is a major research need ahead. A duckweed:maize silage diet (2:1) produced higher growth rates in Holstein heifers (about 200 kg LW) than a maize silage concentrate grass diet, without any detrimental effects (Rusoff et al 1978).

Trichantera gigantea as Feed Supplement for Swine
December 22, 2015 Livestock

What is TRICHANTERA GIGANTEA?

Trichantera gigantea, a fodder tree, also known as Nacedero or Madre de Agua. It was introduced into the country some years ago from Latin America (Columbia and Venezuela) and adapts well in local tropical conditions. It can be planted to a wide range of soil types and elevations up to 1800 meters above sea level. It can be planted at low density at 6,700 cuttings per hectare. It grows well easily between plantation crops and produces 40-60 tons per hectare.

WHAT IS THE NUTRIENT CONTENT OF TRICHANTERA GIGANTEA?

The leaves of trichantera is a potential source of protein, varying from 18-22 in dry matter form and apparently most of this protein are true protein and has a good amino acid balance (Rosales, et.al, 1989). It has 2.8% Crude Fat, 13.4% Crude Fiber,19.7% Ash, and 37.0% NFE.

HOW IS TRICHANTERA GIGANTEA PROPAGATED?

Propagation may be done through cuttings. The cuttings measuring 6-8 inches with 2 nodes are ideal as planting materials. Cuttings can be grown in a plastic bag (10 inches x 6 inches) and allowed to grow in three (3) months before it can be transplanted to the field. However, it can be directly planted to the prepared field.

HOW IS IT FED TO PIGS?

Young leaves can be offered to the pigs in fresh form. It can also be processed into leaf meal and use of ingredients in mash.

HOW MUCH CAN BE FED TO PIGS AS PARTIAL REPLACEMENT FOR COMMERCIAL FEEDS?

Trichantera leaves can replace about 20-30% of the commercial diet of growing-finishing pigs. Six (6) kilograms of fresh leaves consumed by pigs per day is equivalent to 1 kg of mixed feeds saved.

CAN IT BE GIVEN TO OTHER ANIMALS ASIDE FROM PIGS?

Yes. It can be mixed to poultry diets (ducks, hens, quails, rabbits, and even to large (cattle and carabaos) and small ruminants (sheep and goats) feeds.

WHAT ARE THE ECONOMIC BENEFITS WHICH CAN BE OBTAINED FROM SUBSTITUTING TRICHANTERA LEAVES TO COMMERCIAL RATION?

Partial replacement of mixed feeds with Trichantera gigantea give almost the same results in terms of weight gain, meat quality and income with those pigs given sole mixed feeds.

MADRE DE AGUA

The study determined the nutritive value of madre de agua leaf meal for pigs. The chemical analysis showed that madre de agua leaf meal (MDALM) contained 88.44% dry matter, 18.21% crude protein, 12.5% crude fiber, 2.66% crude fat, 21.80% ash, 11.56% moisture, 5% calcium, 0.41% total phosphorus and 2,983kcal/kg gross energy. In vivo digestibility of dry matter, crude protein, crude fiber, calcium and phosphorus by growing-finishing pigs fed diets containing 5, 10 and 15% MDALM were lower than those fed ration without MDALM. The live weight gain, average daily gain, feed conversion efficiency, feed cost per kilogram gain, and age to 90-kg live weight did not differ among pigs fed ration with varying levels of MDALM. Pigs fed 10% MDALM had the highest feed consumption while those that received 15% MDALM had the lowest feed consumption. The highest return above feed and animal cost was obtained on pigs given diet with 10% MDALM. The addition of up to 10% level of MDALM did not affect the slaughter and carcass characteristics of the growing â€“finishing pigs. The raw pork from pigs fed higher levels of MDALM had better color than the rest. All treatment had odor/aroma of the raw and cooked pork, taste/flavor, tenderness, juiciness and over-all acceptability of the cooked pork.

FLAMENGIA

In the Philippines, ruminant diet is low in protein because most smallholders could not afford to buy commercial feed concentrates. Now, farmers may augment the protein needs of ruminants with flemingia (Flemingia macrophylla). Abundantly found in nature, flemingia is a low-cost, high-quality, and sustainable source of protein. Locally known as 'malabalatong,' it is a woody, deep-rooting, tussock forming tropical shrub that grows to about 1-4 m. Flemingia thrives well in acid soil and is drought resistant. It is used as mulch in alley cropping for soil amelioration and soil erosion control in hilly areas. It contains 22.7% crude protein (CP) and 8% tannin. Because of its tannin content, it has low CP digestibility in the rumen of ruminants, which makes it an effective source of bypass protein for animals. Bypass protein passes the rumen undegraded but is digested and absorbed in the small intestine. This protein is more beneficial to the animal because it is directly utilized for higher weight gain, milk yield, among other benefits. Its high tannin content also indicates that it is a natural dewormer.

Although flemingia has lower CP, higher neutral detergent fiber (NDF), and higher condensed tannin than 'ipil-ipil' (Leucaena leucocephala) and 'kakawate' (Gliricidia sepium), it is well compensated by its high bypass protein content. Flemingia is best combined with other forage legume such as stylo, rensonii, desmanthus, ipil-ipil, and kakawate that are easily digested in the rumen. Animals supplemented with flemingia gained weight and had feed efficiency comparable with those supplemented with commercial concentrate.

It is recommended that flemingia be incorporated fresh at the rate of 10-25% in the ration. However, it may be prepared as a leaf meal. To prepare leaf meals, sun-dry the leaves and twigs for 7 hours or air-dry for 5 days at 10-13% moisture content. Grind and store in sacks. Four (4) kilograms of flemingia herbage is needed to prepare 1 kg of leaf meal with 22% CP content.

CHITOSAN

Chitosan *(Kite-O-San),* also known as the "fat magnet" is a substance taken from chitin, a polysaccharide (C8H13NO5) that forms part of the hard outer integument especially of

insects, arachnids, and crustaceans. It is processed out by removing the shells from shellfish like shrimp, lobster, and crabs.

The human use of chitosan can be traced back to 1811 when chitin, source from which it is derived, was first discovered by Braconnot, a professor of natural history in France. According to historians, while Braconnot conducted research on mushrooms, he isolated what later to be called chitin. Some 20 years later, an article on insects was published, which noted that the similar substance was present in the structure of insects and plants. The author called this substance “chitin”. Basically, the name chitin came from the Greek word meaning “tunic” or “envelope”. In 1843, Lassaigne showed the presence of nitrogen in chitin.

Chitosan is a non-toxic polymer derived from chitin. It is made from crustacean shells by a chemical process involving demineralization, deproteinization, decolorization, and deacetylation. Chitosan is a high molecular weight cationic polysaccharide obtained by alkaline deacetylation of chitin, exhibiting excellent film, forming properties, antifungal activity and safety to human. The phusicochemical and biological properties of chitosan justify its introduction in food formulations since it could improve nutritional, hygienic or sensory properties, because of its emulsifying, antimicrobial, antioxidant, and gelling properties, while also acting as a functional fibre. Chitosan has received increased attention for its commercial applications in the biomedical, food and chemical industries. Use ofchitosan in food industry is readily seen due to its several distinctive biological activities and functional properties. The antimicrobial activity and film- forming property of chitosan make it a potential source of food preservative or coating material of natural origin. This review focuses on the applications of chitosan for improvement of quality and shelf life of various foods from agriculture, poultry, and seafood origin.

Research shows that it is a fat inhibitor that seems to work miracles for those in search of a safe way to lose that body fat.

FIBER

Fibre plays a supporting role in poultry nutrition.

Dietary fibre is the part of plant material consisting mainly of cellulosic and non-cellulosic polysaccharides, and a non-carbohydrate component, lignin. These components are highly resistant to hydrolysis by alimentary enzymes and cannot, therefore, be digested or absorbed in the blood stream. Yet fibre plays an important role in poultry diets, if applied properly.

By Dr Salah H. Esmail , Cairo, Egypt

It is generally believed that fibre content of feedstuffs is associated with their bulkiness. In some cases, however, there is no marked relationship between the two. For example, although wheat bran is one of the bulkiest feedstuffs included in feed mixtures for chickens, it contains only about one third as much fibre as do sunflower seeds which are one of the less bulky feeds (9% crude fibre in wheat bran compared with 26% in sunflower seeds).

Other examples of more bulky feedstuffs given to chickens are soybean hulls, alfalfa meal, dried grains, oats, barley and hominy feeds. A few of the less bulky feeds are rice polishing, wheat, meat and bone meal, corn and fishmeal. Shown in Table 1 is the percent crude fibre in each of those feedstuffs.

Fibre requirements. Although the general opinion of poultry producers and feed manufacturers is that the fibre content of the rations should be kept below 7%, production does

not appear to be influenced much by some increase to 8-10%. Studies on broilers showed no adverse effects of such a level of fibre from any source on chicken growth, mortality and feed consumption. With layers, there was no effect on egg production but the efficiency of feed utilisation was reduced, particularly with fibre sources such as oats, barley and wheat bran.

Dietary fibre is preferentially utilised by Lactobacillus and Bifidobacteria species which lead to production of lactic acid and short chain fatty acids. This results in a low pH which will maintain the normal microorganism population, thus preventing the establishment of Salmonella and other pathogens in the gastrointestinal tract. On the other hand, the slow rate of passage of fibre feeds through the gastrointestinal tract should allow for better digestion of feed and microbial fermentation and hence limit food borne pathogen colonisation through the action of the fermentation products.

Fibre and cannibalism. A study was conducted to compare incidence of cannibalism with rations containing 80% yellow corn, and with 8%, 13%, and 18% fibre rations produced by substituting oat mill feed for corn in the aforementioned ration.

The relationship of fibre content of the ration and prevention of cannibalism is not fully understood. Conceivably, it may be related to the increased consumption of feed and the time occupied in eating, or to the increased utilization of sodium and potassium with high fibre diets, as will be indicated later.

Fibre and ammonia emission. A study was conducted to evaluate the effect of including various fibre ingredients in laying-hen diets on ammonia emission. It was found that the fibre ingredients led in all cases to a decrease in ammonia emission from laying-hen manure.

The effect of fibre here could be attributed to two factors:

• Fibre provides energy to bacteria in the lower gastrointestinal tract where the bacteria use nitrogen that would otherwise be excreted as uric acid for bacterial protein synthesis.

• The bacterial metabolism produces short-chain fatty acids that lower manure pH, thereby shifting ammonia (NH_3) to ammonium (NH_4^+), which is less volatile.

The reduced ammonia emission certainly helps alleviate a number of health problems commonly observed in chicken flocks such as as cites, gastrointestinal irritation, respiratory diseases, contact dermatitis, and foot burns. Alleviation of such problems would better be achieved when fibre feeding is considered along with other management practices, such as use of nipple drinkers, balancing bird density with ventilation capacity, and using litter materials with high water-holding capacity, etc.

Yolk and plasma cholesterol. Fibre sources such as ground whole oats, alfalfa meal, or wood shavings greatly reduce egg yolk and plasma cholesterol levels and hence minimise the health hazards associated with consumption of poultry eggs and meat. This could be related to the high levels of bioactive anti-nutritive factors present in fibre feeds such as saponins which possess hypocholesterolemic properties.

It could also be that fibres bind bile acids in the intestines and cause more of such acids to be excreted in the feces. This reduces the amount of bile acids returning to the liver and forces the liver to produce more bile acids to replace those lost in the feces. In order to produce more bile acids, the liver converts more cholesterol into bile acids which lowers egg yolk and plasma cholesterol levels.

Fibre and mineral balance. In long-term feeding of rations having moderate levels of fibre, there might be an improved utilization of minerals. This effect, however, might vary with the source of fibre used. For example, it was found that retention of sodium and potassium was increased by oat hulls, but not affected by fibre sources such as alfalfa meals or soybean hulls.

On the other hand, retention of copper was found to increase with soybean hulls but not with the other two sources of fibre. The three fibre sources equally increased retention of iron, suggesting that the iron contained in either source has a high relative bioavailability. Selection of the fibre source to be incorporated in the ration could, therefore, be an effective means of satisfying requirements for a specific mineral and correcting deficiency.

Fibre and nitrogen balance. Nitrogen balance was found to be higher for hens fed corn DDGS and wheat middling compared with hens fed diets devoid of such fibre sources. This result was expected because amino acids in fibrous feed ingredients are typically less digestible than those in low-fibre ingredients, requiring consumption of larger amounts of amino acids to satisfy the requirement for digestible amino acids. The excretion of nitrogen was unaffected by fibre feeding, indicating that nitrogen retention was higher relative to the control diet.

Pigmentation of egg and meat. Among the different fibre sources, corn DDGS is known to have an effect on yolk color, imparting reddish appearance thereon, which is preferred by most consumers. This is because corn contains relatively high levels of xanthophylls which are primary contributors of yolk pigmentation. The xanthophylls present in corn DDGS also affect meat color, as they can effectively be absorbed and deposited in the abdominal fat pad and skin.

This aspect is particularly important in some parts of the world such as Asian countries where the colored chickens are highly demanded. Studies in Taiwan, for example, have shown that the addition of 20% corn DDGS can decrease the supplementation of artificial pigments by 50% and can thus save up to NT$ 300 (US$ 10) per metric ton of feed due to the reduced artificial pigment supplementation to meet the color requirement of the Taiwan market.

Effects of excess fibre. It is generally accepted that fibres may improve intestinal digestion by reducing the number of goblet cells present on the villous structures in the small intestines, and hence reduce the amount of goblet mucin which acts as a luminal barrier against absorption. This, however, may not always be the case, especially with fibre sources of high molecular weight or those having high methoxyl contents such as citrus pomace, apple pomace, tomato pomace, etc.

Excess feeding of such fibre sources may lead to enlargement of the intestinal villi arising from physical stimulation of villous growth similar to that observed with ruminants fed on high fibre diets, where rumen papillae are also enlarged through the physical action of fibres. The increased size of the villi is often coupled with about two-fold increase in goblet cell numbers which adversely affects absorption. The excessive use of such fibre sources in the diet may also increase viscosity of the intestinal content, with a resulting decrease in bioavailability of vitamin A and utilisation of dietary fats, which adversely affects body weight gain and carcass quality. It is, therefore, recommended to use such sources of fibre in limited amounts when better performance is to be achieved.

Pepita is a Spanish culinary term for the pumpkin seed, the edible seed of a pumpkin or other cultivar of squash. The seeds are typically rather flat and asymmetrically oval, and light green in color and may have a white outer hull.

Vitamins and Minerals Important to Poultry
11 July 2008

Achieving maximum health and performance of poultry requires nutritionally balanced diets, writes Dan L. Cunningham, Extension Coordinator at the University of Georgia.

One of the common issues with regard to backyard flocks relates to poor or inadequate feeding programmes that can lead to vitamin and mineral deficiencies for the birds. Vitamins and minerals are very important components of a chicken's diet and unless a formulated ration is feed, it is likely that deficiencies will occur.

Poultry require all known vitamins except C. Some vitamins are soluble in fats, while others are soluble in water. Some of the symptoms of a vitamin deficiency are as follows:

Fat Soluble Vitamins	
Vitamin A	Decreased egg production, weakness and lack of growth
Vitamin D	Thin shelled eggs, reduced egg production, retarded growth, rickets
Vitamin E	Enlarged hocks, encephalomalacia (crazy chick disease)
Vitamin K	Prolonged blood clotting, intramuscular bleeding

Water Soluble Vitamins	
Thiamine (B1)	Loss of appetite and death
Riboflavin (B2)	Curly-toe paralysis, poor growth and poor egg production
Pantothenic Acid	Dermatitis and lesions on mouth and feet
Niacin	Bowed legs, inflammation of tongue and mouth cavity
Choline	Poor growth, fatty liver, decreased egg production
Vitamin B12	Anaemia, poor growth, embryonic mortality
Folic Acid	Poor growth, anaemia, poor feathering and egg production
Biotin	Dermatitis on feet and around eyes and beak

Minerals are also important to the health and well-being of poultry. The following are some of the important minerals and symptoms of mineral deficiencies:

Minerals	
Calcium	Poor egg shell quality and poor hatchability, rickets
Phosphorus	Rickets, poor egg shell quality and hatchability
Magnesium	Sudden death
Manganese	Perosis, poor hatchability

Iron	Anaemia
Copper	Anaemia
Iodine	Goitre
Zinc	Poor feathering, short bones
Cobalt	Slow growth, mortality, reduced hatchability

As indicated above, vitamin and mineral deficiencies can produce numerous health problems for chickens including in some cases, death. Thus, to prevent nutritional deficiencies, or when deficiency symptoms are noted, feeding a balanced poultry diet with the required vitamins and minerals should be practiced.

Nutrients needed by chicken

Poultry convert feed into food products quickly, efficiently, and with relatively low environmental impact compared with other livestock. The high rate of productivity of poultry results in relatively high nutrient needs. Poultry require the presence of at least 38 dietary nutrients in appropriate concentrations and balance. The nutrient requirement figures published in Nutrient Requirements of Poultry (National Research Council, 1994) are the most recent available and should be viewed as minimal nutrient needs for poultry. They are derived from experimentally determined levels after an extensive review of the published data. Criteria used to determine the requirement for a given nutrient include growth, feed efficiency, egg production, prevention of deficiency symptoms, and quality of poultry product. These requirements assume the nutrients are in a highly bioavailable form, and they do not include a margin of safety. Consequently, adjustments should be made based on bioavailability of nutrients in various feedstuffs. A margin of safety should be added based on the length of time the diet will be stored before feeding, changes in rates of feed intake due to environmental temperature or dietary energy content, genetic strain, husbandry conditions (especially the level of sanitation), and the presence of stressors (such as diseases or mycotoxins).

Water

Water is an essential nutrient. Many factors influence water intake, including environmental temperature, relative humidity, salt and protein levels of the diet, birds' productivity (rate of growth or egg production), and the individual bird's ability to resorb water in the kidney. As a result, precise water requirements are highly variable. Water deprivation for ≥12 hr has an adverse effect on growth of young poultry and egg production of layers; water deprivation for ≥36 hr results in a marked increase in mortality of both young and mature poultry. Cool, clean water, uncontaminated by high levels of minerals or other potential toxic substances, must be available at all times.

Energy Requirements and Feed Intake

The energy requirements of poultry and the energy content of feedstuffs are expressed in kilocalories (1 kcal equals 4.1868 kilojoules). Two different measures of the bioavailable energy in feedstuffs are in use, metabolizable energy (AMEn) and the true metabolizable energy (TMEn). AMEn is the gross energy of the feed minus the gross energy of the excreta after a correction for the nitrogen retained in the body. Calculations of TMEn make an additional correction to account for endogenous losses of energy that are not directly attributable to the foodstuff and are usually a more useful measure. AMEn and TMEn are similar for many ingredients. However, the two values differ substantially for some ingredients such as feather meal, rice, wheat middlings, and corn distiller's grains with solubles.

Poultry can adjust their feed intake over a considerable range of feed energy levels to meet their daily energy needs. Energy needs and, consequently, feed intake also vary considerably with environmental temperature and amount of physical activity. A bird's daily need for amino acids, vitamins, and minerals are mostly independent of these factors. The nutrient requirement values in the following tables are based on typical rates of intake of birds in a thermoneutral environment consuming a diet that contains a specific energy content (eg, 3,200 kcal/kg for broilers). If a bird consumes a diet that has a higher energy content, it will decrease its feed intake; consequently, that diet must contain a proportionally higher amount of amino acids, vitamins, and minerals. Thus, nutrient density in the ration should be adjusted to provide appropriate nutrient intake based on requirements and the actual feed intake.

The Disadvantages of Commercially Raised Chicken

Americans spent about $139 each on chicken in 2007, as reported by the American Meat Institute, making it one of the most popular meats consumed. Several major companies dominate the chicken farming market. These companies have raising chickens down to a science, but many disadvantages come with that science. If you are concerned about issues such as antibiotic administration and animal cruelty, consider shopping for free-range or organic birds.

Salmonella

Commercially raised chickens are raised in crowded conditions. As a result, infections and bacteria spread more readily among the birds. Commercially raised chickens are more likely to carry salmonella, which causes illness in humans. Symptoms of salmonella poisoning are diarrhea and vomiting, with hospitalization or even death occurring in severe cases.

Inhumane Conditions

Commercially raised chickens are often kept in pens without light or access to the outdoors. Animal rights advocates call these practices cruel and unnecessary to the raising of healthy chickens. If you care about the way your chicken was treated before slaughter, this is a distinct disadvantage of commercial chicken farming.

Drugs

Commercially raised chickens are often fed antibiotics to prevent the spread of disease in the farms. Although the Food and Drug Administration requires a waiting period between administration of the drugs and slaughter to help reduce residue of the drugs in the chicken’s system, it does not change the fact that the drugs were administered. The antibiotics used are the same used by humans. Farmers administer antibiotics to prevent disease rather than treat it, which can encourage the development of antibiotic-resistant bacteria.

Additives

Most commercially raised chicken is injected with a salt or monosodium glutamate solution during processing. Adding these solutions plumps the chicken and preserves its pink color. They also increase the sodium content of the meat and can cause health problems in sensitive individuals. Consuming too much sodium is associated with an increased risk of hypertension, or high blood pressure, which may be associated with atherosclerosis and other circulatory problems.

Feed Quality

Commercially raised chickens are fed compounds that may be dangerous to human health, reports a study published in the journal “Environmental Health Perspectives” in April 2008. Some companies have discontinued use of these compounds, but commercially raised chickens may still be eating feed that contains parts of slaughtered chickens, feces, plastics and an overabundance of grains. Some feed also contains arsenic, which helps make chicken meat pink, but could also be hazardous to human health. Poor quality feed could mean poor quality meat.

METHODOLOGY

This chapter shows the research design, subject of the study, materials, tools and equipment, special techniques and procedure, and budgetary requirements used in the study.

RESEARCH DESIGN

This study used the prototyping model, using the principle of the Dairyman’s square to compute for the appropriate formulation of each and every organic material used to meet the nutrient percentage requirement of broiler chicken.

SUBJECT OF THE STUDY

The researchers are using different types of organic raw materials to get the nutrients that are being needed for the production of feeds, such us; Madre de Agua leaves, Flemingia leaves, duckweed, Malunggay leaves, Tilapia fish, and snails. The different organic raw materials produce different nutrients such us; fiber, protein, fats, ash, calcium, phosphorous, and salt in order the chicken to grow.

TOOLS AND EQUIPMENTS

The following materials were being used in the study:

Oven

Mincer

Digital Weighing Scale

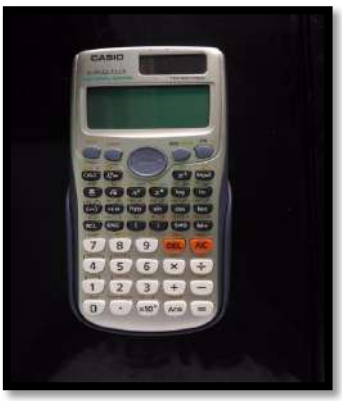
Beaker

Dryer

Knife

Resealable Bag

Pen and Paper



Calculator

Techniques and Procedure

a) Collecting of Raw Materials- Duckweeds, Flemingia leaves, Malunggay leaves, Madre de Agua leaves, and Snails & Tilapia fish are gathered.

b) Drying- combined sun drying and artificial drying techniques are used in preparing the raw materials. The components are dried as follows.

Duckweed

Process	Time Duration	Initial Mass	Final Mass
Sun Drying	2 hrs. and 54 mins.	6 kg	3.05 kg
Artificial Drying	5 hrs. and 22 mins	3.05 kg	0.11kg or 110g

Malunggay Leaves

Process	Time Duration	Initial Mass	Final Mass
Sun Drying	1 hr. and 12 mins.	1 kg	0.75 kg or 750g
Artificial Drying	45 mins.	0.75 kg	0.24 kg or 240g

Madre de Agua Leaves

process	Time Duration	Initial Mass	Final Mass
Sun Drying	3 hrs. and 44 mins.	2.05 kg	1.30kg
Artificial Drying	1 hr. and 9 mins.	1.30kg	0.33kg or 330g

Tilapia Fish

Process	Time Duration	Initial Mass	Final Mass
Sun Drying	2.5 days	1.20 kg	227 g
Oven Drying	2 hrs. @ 130°C	227 g	168 g

Snails

Process	Time Duration	Initial Mass	Final Mass
Oven Drying	50 mins. @ 215°C	236	94 g

c) Mincing- the dried materials are minced and stored in a resealable bag to prevent moisture from evaporating.

d) Mixing- the dried materials are mixed together to produce the final product.

BUDGETARY REQUIREMENTS

Expenses for the production of the product	Price
➢ distilled water	Php 33.00
➢ Zip lock	55.00
➢ Gloves	105.00
➢ Gauze	76.00
➢ Rag	6.00
TOTAL:	Php 275.00

RECOMMENDATIONS

Due to limited amount of time, lack of equipment and resources, the researchers advise to conduct further studies in attempt to utilize organic materials as feeds as an alternative for the existing commercial feeds which is highly available in the market.

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ON PERFECT TOTIENT NUMBER AND ITS GENERATORS

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INTRODUCTION

In the field of mathematics, number theory is one of the most interesting subjects to be studied. One of its fundamental concepts is Euler phi-function that was introduced by Leonhard Euler (1707-1783). This function captivated the eye of young mathematicians to discover new ideas regarding this function and one of the generated ideas on this function was Perfect Totient Number (PTN).

Number theory (or arithmetic) is a branch of pure mathematics devoted primarily to the study of the integers, sometimes called "The Queen of Mathematics" because of its foundational place in the discipline.

Leonhard Euler is a Swiss mathematician and physicist, one of the founders of pure mathematics who introduced the function in 1763. However, he did not at that time choose any specific symbol to denote it. In a 1784 publication Euler studied the function further, choosing the Greek letter π to denote it: he wrote πD for "the multitude of numbers less than D, and which have no common divisor with it". The standard notation $\varphi(A)$ comes from Gauss in 1801. In 1879 J. Sylvester coined the term Totient for this function.

Perfect Totient Number was first studied by Perez Cacho in 1939. This research includes some mathematical computation and some algebraic manipulation in proving its theorems.

A integer n is a Perfect Totient Number (PTN for short) if the sum of its iterated function is equal to n, define by the arithmetic function $S(n) = \phi(n) + \phi^2(n) + \ldots + \phi^c(n) + 1$, where $\phi^c(n) = 2$.

STATEMENT OF THE PROBLEM/OBJECTIVES

This study investigated the properties and relations of Perfect Totient Numbers. Specifically, it sought to determine the following:

1. Definition of Totient and Perfect Totient Number

2. Generators and Sufficient Condition for 3^2p and 3^3p of Perfect Totient Number

3. Relation of Perfect Totient Number to Fermat Primes

SIGNIFICANCE OF THE STUDY

The purpose of this study is to give examples, definition and proofs on the problems regarding Perfect Totient Number. This research may help people in the field of mathematics to

generate idea on the Perfect Totient Number. Specifically, the following may be benefited by this study:

Students. This study especially those students who are taking or will take the subject Number Theory can get interest to study and learn more in mathematics.

Mathematics Professors. Those professors that teaches number theory, they can include this topic on their lectures in Number Theoretic Function, in particular in Euler's Function.

METHODOLOGY

The method that is used in this research is descriptive research but expository in nature.

Descriptive method of research is to describe the characteristics of the phenomenon being studied. It does not answer questions about how/when/why the characteristics occurred, rather it addresses the "what" questions. This is the best method to use since this study aim to describe the subject of the study. This research is also expository in nature because it described, explained, and informed. Every definition has a corresponding example and each theorem were accompanied by illustrations. Moreover, the study was not a survey type of research; hence, no respondents, no statistical treatment of data and no table of result were presented.

RESULTS AND DISCUSSION

1. Definition of Z-matrix

An Z-matrix is a real $n \times n$ matrix $A = [a_{ij}]$ that can be expressed as

$$A = \alpha I - B \qquad (5)$$

where $\alpha > 0$, $B > 0$. The symbols α denotes the scalar and $\alpha \in Z^+$ and I refers to the identity matrix of n order and B is an $n \times n$ matrix which has no negative entries.
A matrix of the form,

$$\begin{bmatrix} a_{11} & a_{12} & -a_{13} \\ -a_{21} & a_{22} & -a_{23} \\ -a_{31} & -a_{32} & a_{33} \end{bmatrix}$$

is called a Z-matrix if it is strictly diagonally dominant and the off diagonal entries are negative or zero.

Example 1. Consider a square matrix B as shown below

$$B = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}, B \geq 0$$

Then to find a Z –Matrix A base on the matrix B that is, by substituting matrix B in equation (5) gives,

$$\begin{aligned} A &= \alpha \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} - \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \\ &= \begin{bmatrix} \alpha & 0 \\ 0 & \alpha \end{bmatrix} - \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \end{aligned}$$

$$= \begin{bmatrix} \alpha - 1 & -2 \\ -3 & \alpha - 4 \end{bmatrix}$$

Then A is a Z-matrix if and only if $\alpha > 3$, $\forall s \in Z^+$. In particular, if $\alpha = 5$ then the new matrix A is

$$A = \begin{bmatrix} 4 & -2 \\ -3 & 1 \end{bmatrix}$$

Then, it can be written as

$$\begin{aligned} A &= 5\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} - \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \\ &= \begin{bmatrix} 5 & 0 \\ 0 & 5 \end{bmatrix} - \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \\ &= \begin{bmatrix} 4 & -2 \\ -3 & 1 \end{bmatrix} \end{aligned}$$

Example 2. To show that this is an Z −Matrix write it in the form of $A = \alpha I - B$ with $\alpha = 7$, then

$$B = \begin{bmatrix} 5 & -2 & 4 \\ -6 & 1 & -5 \\ 2 & 4 & 0 \end{bmatrix}$$

$$A = 7\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} - \begin{bmatrix} 5 & -2 & 4 \\ -6 & 1 & -5 \\ 2 & 4 & 0 \end{bmatrix}$$

$$A = \begin{bmatrix} 7 & 0 & 0 \\ 0 & 7 & 0 \\ 0 & 0 & 7 \end{bmatrix} - \begin{bmatrix} 5 & -2 & 4 \\ -6 & 1 & -5 \\ 2 & 4 & 0 \end{bmatrix}$$

$$A = \begin{bmatrix} 7-5 & 0-(-2) & 0-4 \\ 0-(-6) & 7-1 & 0-(-5) \\ 0-2 & 0-4 & 7-0 \end{bmatrix}$$

$$A = \begin{bmatrix} 2 & 2 & -4 \\ 6 & 6 & 5 \\ -2 & -4 & 7 \end{bmatrix}$$

Then A is an Z-matrix.■

2. Definition of Spectrum. The spectrum of a finite-dimensional matrix is a set of its eigenvalues including repetition, $\sigma(A)$ it denotes the spectrum of a.

3. **Definition of Spectral Radius.** The spectral radius of a matrix is the supremum among the absolute value of the elements $\rho(A) = max\{|\lambda| : \lambda \in \sigma(A)\}$

4. Singular *Z*-Matrix. Z-matrix A is in the form of $A = \alpha I - B$, $\alpha > 0$, $B \geq 0$.It is called singular z-matrix if the spectral radius of b is equal to its scalar or if $\rho(A) = \alpha$

5. Non-singular *Z*-Matrix. Z-Matrix is in the form of $A = \alpha I - B \;\; \alpha > 0, B \geq 0$. An Z-Matrix is non-singular if the spectral radius of matrix B is less than its scalar or $\rho(B) < \alpha$.

6. Statement of Perron-Frobenius Theorem

A matrix in which all entries are positive real numbers is called positive and a matrix whose entries are non-negative real numbers is here called non-negative. The eigenvalues of a real square matrix A are complex numbers and collectively they make up the spectrum of the matrix. The exponential growth rate of the matrix powers A^k as $k \to \infty$ is controlled by the

eigenvalue of A with the largest absolute value. The Perron-Frobenius theorem describes the properties of the leading eigenvalue and of the corresponding eigenvectors when A is a non-negative a real square matrix. Early results were due to Oskar Perron (1907) and concerned positive matrices. Later, George Frobenius (1912) Found their extension to certain classes of non-negative matrices.

7. Positive Matrices. Let $A = [a_{ij}]$ be an $n \times n$ positive matrix: $a_{ij} \geq 0$ for $1 \leq i, j \leq n$.

Then the following statements hold.

7.1. There is a positive real number r, is called the Perron root or the Perron-Frobenius eigenvalue, such as r is an eigenvalue λ is strictly smaller than r in absolute value, $|\lambda| < r$. Thus, the spectral radius $\rho(A)$ is equal to r.

7.2. The Perron-Frobenius eigenvalue is simple: r is a simple root of the characteristic polynomial of A. Consequently, the eigenspace associated to r is one-dimensional.

7.3. There exists an eigenvector $v = (v_{1,\ldots,}v_n)$ of A with eigenvalue r such that all components of vare positive: $Av = vr$ $v_i > 0$ for $1 \leq i < n$.

7.4. There are no other positive eigenvectors except positive multiples of v.

8. Basic Properties of Z-Matrix

Theorem .1 If A and B are Z-Matrices then $A + B$ is a Z-Matrix.

Proof: Let A and B an $m \times n$ Z-Matrix such that,

$$A = \begin{bmatrix} a_{11} & a_{12} & -a_{13} \\ -a_{21} & a_{22} & -a_{23} \\ -a_{31} & -a_{32} & a_{33} \end{bmatrix} \text{ and } B = \begin{bmatrix} b_{11} & b_{12} & -b_{13} \\ -b_{21} & b_{22} & -b_{23} \\ -b_{31} & -b_{32} & b_{33} \end{bmatrix}$$

Gives,

$$A + B = \begin{bmatrix} a_{11} & a_{12} & -a_{13} \\ -a_{21} & a_{22} & -a_{23} \\ -a_{31} & -a_{32} & a_{33} \end{bmatrix} + \begin{bmatrix} b_{11} & b_{12} & -b_{13} \\ -b_{21} & b_{22} & -b_{23} \\ -b_{31} & -b_{32} & b_{33} \end{bmatrix}$$

Then by definition 2.1.1 follows that,

$$A + B = \begin{bmatrix} a_{11} + b_{11} & a_{12} + b_{12} & -(a_{13} + b_{13}) \\ -(a_{21} + b_{21}) & a_{22} + b_{22} & -(a_{23} + b_{23}) \\ -(a_{31} + b_{31}) & -(a_{32} + b_{32}) & a_{33} + b_{33} \end{bmatrix}$$

Thus $A + B$ is a Z-Matrix.■

Illustration 3. Consider C and D are 2×2 Z −Matrices with $\alpha = 7$ such that,

$$C = \begin{bmatrix} 1 & -2 \\ 3 & 1 \end{bmatrix} \text{ and } D = \begin{bmatrix} 4 & 3 \\ -5 & 2 \end{bmatrix}$$

Adding these two matrices gives,

$$C + D = \begin{bmatrix} 1 & -2 \\ 3 & 1 \end{bmatrix} + \begin{bmatrix} 4 & 3 \\ -5 & 2 \end{bmatrix}$$

$$C + D = \begin{bmatrix} 1+4 & (-2)+3 \\ 3+(-5) & 1+2 \end{bmatrix}$$

By obtaining the sum of matrix C and D gives,

$$B = \begin{bmatrix} 5 & 1 \\ -2 & 3 \end{bmatrix}$$

Matrix B can be written in the form of $A = \alpha I - B$ where $\alpha < 7$,

$$A = 7\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} - \begin{bmatrix} 5 & 1 \\ -2 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 7 & 0 \\ 0 & 7 \end{bmatrix} - \begin{bmatrix} 5 & 1 \\ -2 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 7-5 & 0-1 \\ 0-(-2) & 7-3 \end{bmatrix}$$

$$= \begin{bmatrix} 2 & -1 \\ 2 & 4 \end{bmatrix}$$

Thus matrix A is a Z-matrix.■

Illustration 4. Consider x and y are $3x3$ Z-matrices with $\alpha = 7$ such that

$$x = \begin{bmatrix} 1 & 2 & -3 \\ -4 & 2 & -4 \\ -2 & -3 & 1 \end{bmatrix} \text{ and } y = \begin{bmatrix} 1 & 1 & -2 \\ -2 & 3 & -4 \\ 2 & 3 & 4 \end{bmatrix}$$

Adding these two matrices gives,

$$x + y = \begin{bmatrix} 1 & 2 & -3 \\ -4 & 2 & -4 \\ -2 & -3 & 1 \end{bmatrix} + \begin{bmatrix} 1 & 1 & -2 \\ -2 & 3 & -4 \\ 2 & 3 & 4 \end{bmatrix}$$

$$x + y = \begin{bmatrix} 1+1 & 2+1 & -(3+2) \\ (-4+2) & 2+3 & -(4+4) \\ (-2)+2 & (-3)+3 & 1+4 \end{bmatrix}$$

By obtaining the sum of matrix x and y gives

$$A = \begin{bmatrix} 2 & 3 & -5 \\ -6 & 5 & -8 \\ 0 & 0 & 5 \end{bmatrix}$$

Then matrix B can be written in the form of $A = \alpha I - B$

$$A = 7\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} - \begin{bmatrix} 2 & 3 & -5 \\ -6 & 5 & -8 \\ 0 & 0 & 5 \end{bmatrix}$$

$$= \begin{bmatrix} 7 & 0 & 0 \\ 0 & 7 & 0 \\ 0 & 0 & 7 \end{bmatrix} - \begin{bmatrix} 2 & 3 & -5 \\ -6 & 5 & -8 \\ 0 & 0 & 5 \end{bmatrix}$$

$$= \begin{bmatrix} 5 & -3 & 5 \\ 6 & 2 & 8 \\ 0 & 0 & 2 \end{bmatrix}$$

Thus matrix A is a Z-matrix.■

Theorem 3. The transpose of Z-Matrix is a Z-Matrix.

Proof: Let A be an $n \times n$ Z-Matrix then,

$$A = \begin{bmatrix} a_{11} & a_{12} & -a_{13} \\ -a_{21} & a_{22} & -a_{23} \\ -a_{31} & -a_{32} & a_{33} \end{bmatrix}$$

By taking the transpose of A gives,

$$A^T = \begin{bmatrix} a_{11} & -a_{21} & -a_{31} \\ a_{12} & a_{22} & -a_{32} \\ -a_{13} & -a_{23} & a_{33} \end{bmatrix}$$

Since A^T follows the definition of Z-Matrix then A^T is a

Z-Matrix.■

Illustration 5. Consider again a 2×2 Z-Matrix A as shown below,

$$A = \begin{bmatrix} 4 & -2 \\ -2 & 8 \end{bmatrix}$$

By taking A^T yields,

$$A^T = \begin{bmatrix} 4 & -2 \\ -2 & 8 \end{bmatrix}$$

Thus matrix A is a Z-Matrix.■

Theorem 4. For all m positive matrix whose main diagonal strictly zero and scalar $C < 0$ then CA is a Z −Matrix.

Proof: Let A be a positive matrix whose main diagonal is zero such that,

$$A = \begin{bmatrix} 0 & a_{12} & -a_{13} \\ -a_{21} & 0 & -a_{23} \\ -a_{31} & -a_{32} & 0 \end{bmatrix}$$

For all scalar $C < 0$ then,

$$CA = \begin{bmatrix} c(0) & c(a_{12}) & c(-a_{13}) \\ c\,(-a_{21}) & c(0) & c(-a_{23}) \\ c(-a_{31}) & c(-a_{32}) & c(0) \end{bmatrix}$$

Since $C < 0$ then all off diagonal entries will be negative it follows that CA is a Z −Matrix.■

Illustration 6.

$$A^T = \begin{bmatrix} 11 & -1 & 0 \\ -3 & 7 & -10 \\ 0 & -6 & 16 \end{bmatrix}$$

Thus matrix A is a Z-Matrix.

Theorem 5. For all m positive matrix whose main diagonal strictly zero and scalar $c < 0$ then cA is a Z-Matrix.

Proof: Let A be a positive matrix whose diagonal is zero such that,

$$A = \begin{bmatrix} 0 & a_{12} & \dots & a_{1n} \\ a_{21} & 0 & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \dots & 0 \end{bmatrix}$$

For all scalar $c < 0$ then,

$$cA = \begin{bmatrix} c(0) & c(a_{12}) & \dots & c(a_{1n}) \\ c(a_{21}) & c(0) & \dots & c(a_{2n}) \\ \vdots & \vdots & \ddots & \vdots \\ c(a_{m1}) & c(a_{m2}) & \dots & c(0) \end{bmatrix}$$

Since $c < 0$ then all off diagonal entries will be negative it follows that cA is a Z-Matrix.■

Illustration 7. Consider a 2×2 Z-matrix A as shown below,

$$A = \begin{bmatrix} 0 & 2 \\ 3 & 0 \end{bmatrix}$$

And let $c = -2$ it can be written as cA gives,

$$cA = -2\begin{bmatrix} 0 & 2 \\ 3 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} 0 & -4 \\ -6 & 0 \end{bmatrix}$$

Thus matrix A is a Z-Matrix.

Illustration 8. Consider a 3×3 Z-Matrix A as shown below,

$$A = \begin{bmatrix} 0 & 2 & 4 \\ 3 & 0 & 6 \\ 4 & 8 & 0 \end{bmatrix}$$

And let $c = -3$ it can be written as cA gives,

$$cA = -3\begin{bmatrix} 0 & 2 & 4 \\ 3 & 0 & 6 \\ 4 & 8 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} 0 & -6 & -12 \\ -9 & 0 & -18 \\ -12 & -24 & 0 \end{bmatrix}$$

Thus, matrix A is a Z-Matrix.

9. Other Properties of Z-Matrix.

Theorem 6. The $n \times n$ matrix T is semi convergent if $\rho(T) \leq 1$.

Proof: Let $A \in Z^{n \times n}$ be an Z −Matrix such that $A = \alpha I - B, \alpha > 0, B \geq 0$ and $\rho(B) \leq \alpha$. There exists $T \leq B$ where $T \leq {}^{B}/_{\alpha}$ is semi convergent. Diagonal $B > 0$ and therefore also diag$({}^{B}/_{\alpha}) > 0$, and notice that $\rho(B) \leq \alpha$. In that case, multiplying both sides of the inequality by ${}^{1}/_{\alpha}$ yields to,

$$\frac{1}{\alpha}[\rho(B)] \leq [\alpha]\frac{1}{\alpha}$$

$$\rho({}^{B}/_{\alpha}) \leq 1$$

Thus, $\rho(T) \leq 1$, where $T = {}^{B}/_{\alpha}$.■

Illustration 9. Consider a 2×2 Z-matrix A.

$$A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

By solving for matrix B using equation (5), since $B = \alpha I$. A gives

$$B = \alpha \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} - \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$B = \begin{bmatrix} \alpha & 0 \\ 0 & \alpha \end{bmatrix} - \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$B = \begin{bmatrix} \alpha - 0 & 0 \\ o & \alpha - 0 \end{bmatrix}$$

Then, A is an Z-matrix for $\alpha > 0$.

By computing $P(B)$ to determine if it is singular or non-singular Z-matrix using equation (4) gives

$$det \left| \lambda \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} - \begin{bmatrix} 4 & 0 \\ 0 & 4 \end{bmatrix} \right| = 0$$

$$det = \left| \begin{bmatrix} \lambda & 0 \\ 0 & \lambda \end{bmatrix} - \begin{bmatrix} 4 & 0 \\ 0 & 4 \end{bmatrix} \right| = 0$$

$$det \left| \begin{bmatrix} \lambda - 4 & 0 \\ 0 & \lambda - 4 \end{bmatrix} \right| = 0$$

By getting the determinant gives,

$$|\lambda I - B| = (\lambda - 4)(\lambda - 4) - 0 = 0$$

$$\sigma(B) = (4,4)$$

Since the supremum among the eigenvalues of B is 4, then $P(B) < \alpha$. Therefore Z-matrix A is non-singular.

To get b matrix $T, = {}^{B}/_{\alpha}$ results to,

$$B = \left[\begin{bmatrix} \alpha - 1 & 0 \\ 0 & \alpha - 1 \end{bmatrix} \right]$$

Let $\alpha = 5$

$$B = \begin{bmatrix} 5 - 1 & 0 \\ 0 & 5 - 1 \end{bmatrix} = \begin{bmatrix} 4 & 0 \\ 0 & 4 \end{bmatrix}$$

It follows that,

$$T = \begin{bmatrix} {}^{4}/_{5} & 0 \\ 0 & {}^{4}/_{5} \end{bmatrix}$$

Compute $P(T)$ to determine if matrix T is semi-convergent. By using equation (4) yields to,

$$det \left| \lambda \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} - \begin{bmatrix} {}^{4}/_{5} & 0 \\ 0 & {}^{4}/_{5} \end{bmatrix} \right| = 0$$

$$det \left| \begin{bmatrix} \lambda & 0 \\ 0 & \lambda \end{bmatrix} - \begin{bmatrix} {}^{4}/_{5} & 0 \\ 0 & {}^{4}/_{5} \end{bmatrix} \right| = 0$$

$$det \left| \begin{bmatrix} \lambda - {}^{4}/_{5} & 0 \\ 0 & \lambda - {}^{4}/_{5} \end{bmatrix} \right| = 0$$

By getting the determinant gives,

$$|\lambda I - T| = \left(\lambda - {}^{4}/_{5}\right)\left(\lambda - {}^{4}/_{5}\right) - 0 = 0$$

$$\sigma(T) = \left({}^{4}/_{5}, {}^{4}/_{5}\right)$$

Therefore $\rho(T) = {}^{4}/_{5}$ and since $\rho(T) < 1$, then matrix T is semi convergent. Since it satisfies the condition $p(T) = 1$ has then Z-matrix A has a square root.

Notice that all non-singular Z-matrices has $p(T) = 1$ but not all Z-matrices share the property because by the definition of Perron Frobenious Theorem, every eigenvalue $(\lambda), \exists \mu(T) < \rho(T)$. There are however singular Z-matrices which do not share this property.

Theorem 7. If $\rho(T) \leq 1$, then all elementary divisors associated with the eigenvalue 1 of T are linear.

Proof: It shows that all elementary divisors associated with eigenvalue 1 of ${}^{B}/_{\alpha}$ are linear. Let $\mu = \{T\} = \max\{|\lambda|\}, \lambda$ is an

associated with an eigenvalue λ of B by the equation $1 - \mu = (\alpha - \lambda)^2$ if now ${}^{\lambda}/_{\alpha} = 1$,

$$\begin{aligned} 1 - \mu &= \alpha^2 - 2\alpha\lambda + \lambda^2 \\ \frac{1 - \mu - \lambda^2}{\alpha} &= \frac{\alpha(\alpha - 2\lambda)}{\alpha} \\ \frac{1}{\alpha}\left[\frac{1}{\alpha} - {}^{\mu}/_{\alpha} - \lambda\right] &= [\alpha - 2\lambda]\frac{1}{\alpha} \\ \frac{1 - \mu}{\alpha^2} - \frac{\lambda}{\alpha} &= \frac{\alpha}{\alpha} - \frac{2\lambda}{\alpha} \\ \frac{1 - \mu}{\alpha^2} - 1 &= 1 - 2 \\ \alpha^2\left[\frac{1 - \mu}{\alpha^1}\right] &= [-1 + 1]\alpha^2 \\ 1 - \mu &= 0 \\ \mu &= 1 \end{aligned}$$

It follows that if μ is an eigenvalue of p the elementary divisors of which are linear and the elementary divisors of the related eigenvalue λ are also linear. Since T is semi convergent then theorem $1(b)$ holds for T and also for ${}^{B}/_{\alpha}$.

Theorem 8. If $\rho(T) = 1$ then $\lambda \in \sigma(T)$ with $|\lambda| = 1$ implies $\lambda = 1$.
Proof: If A is an Z-matrix and $A = \alpha I - B, B \geq 0$ with, then theorem $1(c)$ is automatically satisfied by $= {}^{B}/_{\alpha}\ \alpha > \max iaij$,

Illustration 10. Consider Matrix A

$$A = \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}, \alpha = 1$$

By solving for matrix B using equation (5), then $\alpha I - A$ gives,

$$B = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} - \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$$

$$B = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$$

By computing $\rho(B)$ to determine if it is singular or non-singular Z-matrix using equation (4) gives,

$$\det\left|\lambda\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}-\begin{bmatrix}1 & -1\\ -1 & 1\end{bmatrix}\right|=0$$

$$det\left|\begin{bmatrix}\lambda & 0\\ 0 & \lambda\end{bmatrix}-\begin{bmatrix}1 & -1\\ -1 & 1\end{bmatrix}\right|=0$$

$$det\left|\begin{bmatrix}\lambda & -1\\ -1 & \lambda\end{bmatrix}\right|=0$$

By getting the determinant gives,

$$|\lambda I-B|=(\lambda^2-1)-0=0$$

$$=(\lambda-1)(\lambda+1)$$

$$\sigma(B)=(1,-1)$$

Since the supremum among the eigenvalues of B is 1, then $\rho(B)=\alpha$, therefore Z –Matrix A is singular.

To get matrix $T, T={}^{B}/_{\alpha}$ results to,

$$B=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$$

$$T=\begin{bmatrix}0 & {}^{1}/_{\alpha}\\ {}^{1}/_{\alpha} & 0\end{bmatrix}$$

Compute $\rho(T)$ to determine if matrix T is semi convergent using equation (4) yields to,

$$det\left|\lambda\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}-\begin{bmatrix}0 & 1\\ 1 & 0\end{bmatrix}\right|=0$$

$$det\left|\begin{bmatrix}\lambda & 0\\ 0 & \lambda\end{bmatrix}\begin{bmatrix}0 & 1\\ 1 & 0\end{bmatrix}\right|=0$$

$$det\left|\begin{bmatrix}\lambda & -1\\ -1 & \lambda\end{bmatrix}\right|=0$$

Getting the determinant gives,

$$\begin{aligned}|\lambda I-T| &= (\lambda^2-1)=0\\ &= (\lambda-1)(\lambda+1)=0\\ \sigma(T) &= (1,-1)\\ \rho(T) &= 1\end{aligned}$$

Since $T=(BI\alpha)$ for $\alpha-1$ is not semi-convergent then Z –Matrix A doesn't have square root. Notice also that from Perron Frobenious Theorem if A is an Z –Matrix with $s>\max a_{ij}$, then condition (3) is automatically satisfied by matrix T, $T=\left({}^{B}/_{\alpha}\right)$ is semi-convergent.

Illustration 11. Consider Matrix A.

$$A=\begin{bmatrix}1 & -1\\ -1 & 1\end{bmatrix},\qquad \alpha=3$$

With the given A and $B=\alpha I-A$, then

$$B=3\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}-\begin{bmatrix}1 & -1\\ -1 & 1\end{bmatrix}$$

$$B=\begin{bmatrix}3 & 0\\ 0 & 3\end{bmatrix}-\begin{bmatrix}1 & -1\\ -1 & 1\end{bmatrix}$$

$$B=\begin{bmatrix}2 & 1\\ 1 & 2\end{bmatrix}$$

By solving for $T={}^{B}/_{\alpha}$ results to,

$$T = \begin{bmatrix} 2/3 & 1/3 \\ 1/3 & 2/3 \end{bmatrix}$$

By computing $\rho(T)$ to determine if matrix T is semi-convergent using equation (4) yields to,

$$det\left|\begin{bmatrix} \lambda & 0 \\ 0 & \lambda \end{bmatrix} - \begin{bmatrix} 2/3 & 1/3 \\ 1/3 & 2/3 \end{bmatrix}\right| = 0$$

$$det\begin{bmatrix} \lambda - 2/3 & -1/3 \\ -1/3 & \lambda - 2/3 \end{bmatrix} = 0$$

By getting the determinant gives,

$$\begin{aligned} |\lambda I - T| &= det\left|\lambda\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} - \begin{bmatrix} 2/3 & 1/3 \\ 1/3 & 2/3 \end{bmatrix}\right| \\ &= 0 \\ &= (\lambda - 2/3)(\lambda - 2/3) - [(-1/3)(-1/3)] = 0 \\ &= \lambda^2 - 4/3 + 4/9 - 1/9 = 0 \\ &= \lambda^2 - 4/3\,\lambda + 1/9 = 0 \\ &= (\lambda - 1)(\lambda - 1/3) = 0 \end{aligned}$$

$$\sigma(T) = (1, 1/3)$$

$$\rho(T) = 1$$

Thus, matrix A has a square root. Since it satisfies the following conditions in $p(T) = 1$.

10. Input-output Analysis of Z −Matrix

The study of Z-Matrix has an important economic application. This branch of applied mathematics is called an input-output analysis and was first proposed by Wassily Leontlef, who won the nobel prize in economics in 1973 for his work in this area.

Input-Output Problem

The main problem of input-output analysis the following: consider an economy with several industries. Each industry has a demand for products from other industries (Internal Demand). There are also external demands from the outside.

Example 12. Two-industry Model

Each dollar's worth of agriculture produced requires $\$0.40$ of agriculture and $\$0.20$ of energy. Each dollar's worth of energy produced requires $\$0.20$ of agriculture and $\$0.10$ of energy. So, both industries have an internal demand for each other resources. Let us suppose there is an external demand of $\$12{,}000{,}000$ of agriculture and $\$9{,}000{,}000$ dollars of energy. Find a production level for the industries that will meet both internal and external demands.

Solutions:

Let x represent the total output from agriculture and y represent the total output of energy (in millions of $). The expressions

$$0.4x + 0.2y$$

$$0.2x + 0.1y$$

Can be used to represent the internal demands for agriculture and energy. The external demands of 12 and 9 million must be met, so the revised equation are.

$$x = 0.4x0.2y + 12$$

$$y = 0.2x + 0.1y + 9$$

These equations can be represented by the following matrix equation:

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 0.4 & 0.2 \\ 0.2 & 0.1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} 12 \\ 9 \end{bmatrix}$$

By solving this matrix equation as follows:

$$x = Mx + D$$

$$x - Mx = D$$

$$1x - Mx = D$$

$$(1 - M)x = D$$

$$x = (I - M)^{-1}D$$

If the inverse of $(I - M)$ exists. First, find $(I - M)$

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} - \begin{bmatrix} 0.4 & 0.2 \\ 0.2 & 0.1 \end{bmatrix} = \begin{bmatrix} 0.6 & -0.2 \\ -0.2 & 0.9 \end{bmatrix}$$

By solving the inverse of $(I - M)$ yields to,

$$\frac{1'}{(0.6)(0.9) - [(0.2)(0.2)]} \begin{bmatrix} 0.9 & 0.2 \\ 0.2 & 0.9 \end{bmatrix}$$

$$\frac{1'}{.54 - .04} \begin{bmatrix} 0.9 & 0.2 \\ 0.2 & 0.6 \end{bmatrix}$$

$$\frac{1'}{.5} \begin{bmatrix} 0.9 & 0.2 \\ 0.2 & 0.6 \end{bmatrix}$$

$$2 \begin{bmatrix} 0.9 & 0.2 \\ 0.2 & 0.6 \end{bmatrix}$$

Thus the inverse of $(I - M)$ is,

$$\begin{bmatrix} 1.8 & 0.4 \\ 0.4 & 1.2 \end{bmatrix}$$

After finding the inverse of $(I - M)$, multiply that result by the external demand matrix D. The answer is: Produce a total of $25.2 million of agriculture and $15.6 million of energy to meet both the internal demand of each resource and the external demand.

$$(I - M)^{-I}D = \begin{bmatrix} 1.8 & 0.4 \\ 0.4 & 1.2 \end{bmatrix} \begin{bmatrix} 12 \\ 9 \end{bmatrix} \begin{bmatrix} 25.2 \\ 15.6 \end{bmatrix}$$

Suppose consumer demand changes from $12 million dollars of agriculture to $8 million dollars and energy consumption changes from $9 million to $5 million. Find the output for each sector that is needed to satisfy this final demand.

Solution: Recall that the general solution of the problem is a $x = (I - M)^{-I}D$.

The only change in the problem is the external demand matrix. $(I-M)$ did not change. Therefore, the solution is to multiply the universe of $(I-M)$ by the new external demand matrix D.

$$x = (I-M)^{-I}D$$

$$\begin{bmatrix}1.8 & 0.4\\ 0.4 & 1.2\end{bmatrix}\begin{bmatrix}8\\ 5\end{bmatrix} = \begin{bmatrix}16.4\\ 9.2\end{bmatrix}$$

More than two sectors of the economy.

This method can also be used if there are more than to sectors of economy. If there are three sectors, life agriculture, building and energy, the technology matrix M will be 3x3 matrix. The solution to the problem will still be,

$$x = (I-M)^{-I}$$

Although in this case it is necessary to determine the inverse of $3x3$ matrix.

Example 13. An economy is based on three sectors, agriculture (A), energy (E), and manufacturing (M). Production of a dollar's worth of agriculture requires an input of \$0.20 from the agriculture sector and \$0.40 from the energy sector.

Production of a dollar's worth of energy requires an input of \$0.20 the energy sector \$0.40 from the manufacturing requires an input of \$0.10. From the agriculture sector, \$0.10 from the energy sector, and \$0.03 from the manufacturing sector. Find the output demand of \$20 billion for agriculture, \$10 billion for energy, and \$30 billion for manufacturing.

$$\begin{bmatrix}0.2 & 0 & 0.1\\ 0.4 & 0.2 & 0.1\\ 0 & 0.4 & 0.3\end{bmatrix} = M$$

$$I-M = \begin{bmatrix}1 & 0 & 0\\ 0 & 1 & 0\\ 0 & 0 & 1\end{bmatrix} - \begin{bmatrix}0.2 & 0 & 0.1\\ 0.4 & 0.2 & 0.1\\ 0 & 0.4 & 0.3\end{bmatrix}$$

$$I-M = \begin{bmatrix}0.2 & 0 & -0.1\\ 0.4 & 0.2 & -0.1\\ 0 & 0.4 & 0.7\end{bmatrix}$$

By solving for the inverse of $(I-M)$ yields to,

$$(I-M)^{-1} = \frac{1}{4}\begin{vmatrix}\begin{vmatrix}0.8 & -1\\ -0.4 & 0.7\end{vmatrix} & \begin{vmatrix}-1 & 0\\ 0.7 & -0.4\end{vmatrix} & \begin{vmatrix}0 & -0.1\\ 0.8 & -0.1\end{vmatrix}\\ \begin{vmatrix}-0.1 & -0.4\\ 0.7 & 0\end{vmatrix} & \begin{vmatrix}0.8 & -0.1\\ 0 & 0.7\end{vmatrix} & \begin{vmatrix}-0.1 & 0.8\\ -0.1 & -0.4\end{vmatrix}\\ \begin{vmatrix}-0.4 & 0.8\\ 0 & -0.4\end{vmatrix} & \begin{vmatrix}0 & 0.8\\ 0.4 & 0\end{vmatrix} & \begin{vmatrix}0.8 & 0\\ -0.4 & 0.8\end{vmatrix}\end{vmatrix}$$

$$I-M^{-1} = 2.5\begin{bmatrix}.52 & .04 & .08\\ .28 & .56 & .12\\ .16 & .32 & .64\end{bmatrix}$$

$$I-M^{-1} = \begin{bmatrix}1.3 & 0.1 & 0.2\\ 0.7 & 1.4 & 0.3\\ 0.4 & 0.8 & 1.6\end{bmatrix}$$

Thus, the output matrix X is given by:

$$\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix} = \begin{bmatrix}1.3 & 0.1 & 0.2\\ 0.7 & 1.4 & 0.3\\ 0.4 & 0.8 & 1.6\end{bmatrix}\begin{bmatrix}20\\ 10\\ 30\end{bmatrix} = \begin{bmatrix}33\\ 37\\ 64\end{bmatrix}$$

An output of $33 billion for agriculture, $37 billion for energy and $64 billion for manufacturing will meet the given final demands.

CONCLUSIONS

Based from the findings of the study, the following conclusions were constructed:

1. All based of 3^k is Perfect Totient Number
2. There are generators of Perfect Totient Number
3. All Perfect Totient Number satisfies the Euler Theorem
4. There are sufficient Conditions for a number to become a Perfect Totient Number
5. All Perfect Totient Number are odd but φ of all $n > 2$ are even

RECOMMENDATIONS

The summary of findings as well as the conclusions had led to the formulation of the following recommendations that the future researchers may undertake:

1. On study of Super Perfect Totient Number
2. On Perfect Totient Number that satisfies the Euler's Theorem and Fermat Little Theorem
3. On Mersenne number as generators of Perfect Totient Number

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APPENDIX

First 39 Perfect Totient Numbers

N	PTN	N	PTN
1	3	18	4359
2	9	19	4375
3	15	20	5571
4	27	21	6561
5	39	22	8751
6	81	23	15723
7	111	24	19683
8	183	25	36759
9	243	26	46791
10	255	27	59049
11	327	28	65535
12	363	29	140103
13	471	30	177147
14	729	31	208191
15	2187	32	441027
16	2199	33	531441
17	3063	34	1594323

KAHUSAYANG GRAMATIKA SA FILIPINO: BATAYAN SA PAGBUO NG BABASAHING PANGGRAMATIKA

Nelia A. Ortega

PANIMULA

Ang tao ay pinagkalooban ng Diyos na makapagsalita upang maipahayag ang kanyang iniisip at nadarama. Sa pagpapahayag naisisiwalat ang kaalaman, paniniwala, nasasaloob at mithiin sa pamamagitan ng wika. Ayon kay Constantino (2005), wika ang pangunahing instrumento ng tao upang makapaghayag ng damdamin, niloloob at iniisip. Ang wika ay behikulo ng komunikasyon ng dalawang taong nag-uusap. Ginagamit nila ang wika upang ipahayag ang kanilang pangangailangan, damdamin at ang kanilang iniisip. Ginagamit nila ang wika sa kanilang pakikipag-ugnayan sa lahat ng pagkakataon. Kung gayon, wika ang daan o tulay na daluyan ng nadarama o naiisip ng tao anumang oras, anumang araw sa anumang panahon. Dahil din sa wika natuklasan ang pagsulat.

Ang wika ay naging sistema na nang pagpapahayag sa pagsasalita at pagsulat. Sa aklat nina Carpio at mga kasama (2012), nabanggit na ayon kay Henry Gleason, isang lingguwista, ang wika ay masistemang balangkas ng sinasalitang tunog na pinili at isinaayos sa paraang abitraryo upang magamit sa pakikipagtalastasan ng mga taong kabilang sa isang kultura. Ayon kay Austero (2011), ang wika ay isang masistemang balangkas dahil binubuo ito ng mga makabuluhang tunog (fonema) na kapag pinagsama-sama ay makalilikha ng makabuluhang sikwens ng mga salita (morfema) na bumabagay sa iba pang salita (semantiks) upang makabuo ng mga pangungusap na may istraktyur (sintaks) na nagiging basehan ng pagpapakahulugan sa paggamit ng wika. Malinaw na isang sistema ang wika na kailangang panatilihing maayos upang magamit sa pakikipag-uganayan ng tao sa kanyang kapwa. Ayon kay Lartec (2011), kapag ang sistema ay malalabag, ito ay magreresulta ng mali at malabong pahayag na labis na nakaaapekto sa takbo ng komunikasyon.

Ang wika bilang sistema ay nagtataglay ng mga sangkap na dapat isaalang-alang upang mapanatiling maayos. Isa sa mga sangkap na ito ay gramatika o balarila. Mahalaga ang ginagampanan ng gramatika sa pagpapahayag; kailangang nasusunod ang wastong kaayusan ng mga salita. Ang ganitong diwa ay nagsasaad ng tiyak na kahalagahan ng gramatika o balarila sa pagbubuo ng isa o mga pahayag. Ang kaayusan ng mga salita sa loob ng pangungusap o talata ay magbibigay ng malinaw na kaisipan at tiyak na mensahe sa mga mambabasa o makikinig. Ang malinaw, maayos at wastong salita at pangungusap ay nagdudulot ng pagkakaunawaan at malusog na pakikipag-ugnayan. Sa ganitong punto, nararapat na malinang sa tao, higit sa mga mag-aaral ang kakayahan at kahusayang panggramatika, ganoon din ang pagkakaroon ng kasanayang pangkomunikatibo.

Ang mga pahayag na ito ang nagtulak sa mananaliksik upang pag-aralan ang kahusayan at kasanayan sa Filipino ng mga mag-aaral, dahil ang Filipino ang mabisang instrumentong ginagamit ng Pilipino sa pakikipagkomunikasyon sa anumang larangan. Ang anumang resulta ng pagsusuri ay magiging batayan sa pagbuo ng babasahing panggramatika bilang pantulong na sangggunian para sa mas mabilis na paglinang sa wika

PAGLALAHAD NG SULIRANIN

Ang pangunahing layunin ng pag-aaral na ito ay matukoy ang antas ng kahusayang panggramatika ng respondente. Kaugnay nito, nilikom ng pag-aaral ang kasagutan sa mga

tiyak na suliraning nasa ibaba:

1. Ano-ano ang mga antas ng kahusayang panggramatika sa Filipino ng mga sangkot na tagatugon batay sa:

   1.1. Wastong gamit ng mga salita;

   1.2. Ayos ng mga salita sa pangungusap/sintaks;

   1.3. Gamit ng bantas sa pagsulat?

2. Ano ang kahirapan/kahinaan ng mga mag-aaral sa kaalamang panggramatika batay sa tatlong nabanggit na aspeto ng wika?

3. Anong disenyo ng babasahing panggramatika ang maaaring buoin batay sa kinalabasan ng pagsusulit?

PAMAMARAANG GINAMIT

Ang mananaliksik ay gumamit ng pamamaraang palarawan o deskriptibo upang mailarawan ang kasalukuyang kalagayan ng kahusayang panggramatika ng mga mag-aaral. Naniniwala ang mananaliksik na sa pamamagitan ng deskriptibong pamamaraan ay makatotohanang maipakikita ang kalakasan, at kahinaan ng kakayahan ng mga mag-aaral sa gramatika. Sinusubukan din ng pamamaraang ito na ilarawan ang kasalukuyang kalagayan, kaganapan o mga sistema batay sa impresyon o reaksyon ng mga respondente.

NATUKLASAN

Sa mga datos na nakalap, nabuo ng mananaliksik ang sumusunod na natuklasan:

1. Na sa paggamit ng Nang/Ng, 196 o 98% ang nakakuha ng Wasto, samantalang 4 o 2% ang nakakuha ng maling kasagutan; sa Hagdan/hagdanan,105 o 52.5% ang nakakuha ng wasto at 95 o 47.5% nakakuha ng mali; sa Hagis/ihagis, 196 o 98.5% ang nakakuha ng wasto at 4 o 2% ang nakakuha ng mali; sa Ooperahan/ooperahin, 197 o 98.5% ang nakakuha ng wasto, samantalang 3 o 1.5% ang nakakuha ng mali; sa Pahirin/ Pahiran, 192 o 96% ang nakakuha ng wasto at 8 o 4 % ang nakakuha ng mali; sa May/mayroon 106 o 53% ang nakakuha ng wasto at 94 o 47% ang nakakuha ng mali; sa Subukin/subukan ay 16 o 8% ang nakakuha ng wasto at 184 o 92% ng nakakuha ng mali; sa Sundan/Sundin, 195 o 97.5% ang nakakuha wasto, samantalang 5 o 2.5% ang nakakuha ng mali; sa Hatiin/hatian ay 196 o 98% ang nakakuha ng wasto, samantalang 4 o 2% ang nakakuha ng mali; at, sa Pinto/Pintuan, 55 o 27.5% ang nakakuha ng wasto at 145 o 72.5% ang nakakuha ng mali. Ang *average* na iskor ng mga mag-aaral sa pagsusulit sa wastong gamit ng mga salita at ang antas ng kanilang kaalamang pangwika batay sa nasabing kraytirya ay 82.55 at may antas na Mataas sa Karaniwang Kahusayan ang kaalaman. Para sa ayos ng mga salita sa pangungusap/sintaks, ay matutunghayan ang sumusunod na iskor: batay sa panuring at tinuturingan, na sa kabuoang 200 o 100%, sa pangungusap na “Tumapon ang kumukulong sabaw mula sa kaldero.”, 185 o 92.5% ang nakakuha ng wastong sagot samantalang 15 o 7.5% ang mali ang sagot; sa pangungusap na “Nagtanong ang guro sa mahusay na si Efren.”, nakakuha ng 60 o 30% na wastong sagot at 140 o 70% na maling sagot; at sa pangungusap na “Higit na mabuti ang pakiramdam ko ngayon.", nakakuha ng 186 o 93% na wastong sagot at 14 o 7% na maling sagot; ang iskor naman ng mga mag-aaral sa ayos ng mga salita sa pangungusap/sintaks batay sa timbangan ng salita o paralelismo, nakakuha ng 98 o 49% na wastong sagot samantalang 2 o 1% na maling sagot ang pangungusap na "Nagsialis at

nagsiuwi ang mga panauhin."; 42 o 21% na wastong sagot at 158 o 79% na maling sagot ang pangunusap na "Matapos magsitangis ay agad nagbalot ng gamit ang mga napaalis na selttler"; at, 135 o 67.5% na wastong sagot at 65 o 32.5% na maling sagot ang pangungusap na "Magkakasindunong ang magkapatid na Joshua at Junel."; sa Ayos ng mga salita sa pangungusap/sintaks batay sa pagkilala ng bahagi ng panalita na Pangngalan, nakakuha ng 53 o 26.5% na wastong sagot samantalang 147 o 73% ang maling sagot sa pangungusap na "Maglalakbay ang pamilya kasama si ama."; 32 o 16% na wastong sagot at 168 o 84% na maling sagot sa pangungusap na "Si Ate ay mabuting ehemplo ng kagandahang asal."; 111 o 55.5% na wastong sagot at 89 o 44.5% na maling sagot sa pangungusap na "Ang dalawang kambal/ay sabay/lumuwas ng Maynila."; at 142 o71% na wastong sagot at 58 o29% na maling sagot sa pangungusap na "Ibinigay ko/sa nanay/ang perang /pambili."; na panghalip, nakakuha ng 103 o 51.5% na wastong sagot at 97 o 48.5% na maling sagot sa pangungusap na "Ang ilong mo/ ay matangos/tulad ko."; 102 o 51% na wastong sagot at 9 o 49% na maling sagot sa pangungusap na "Doon /mo ilagay/ sa tabi ko/ ang bata."; at 56 o 28% na wastong sagot at 144 o 72% na maling sagot sa pangungusap na "Ilan ang timbang / ng/ baboy na/ nabili mo."; na pang-uri, nakakuha ng 186 o 93% na wastong sagot at 14 o 7% na maling sagot ang pangungusap na "Ang mabuting bata ay pinagpapala."; at, 113 o 56.5% na wastong sagot at 87 o 43.5% na maling sagot sa pangungusap na "Pagod at paupong / nakatulog / ang hapo at inaantok na gwardiya."; na pandiwa, nakakuha ng 179 o 89.5% na wastong sagot samantalang 21 o 10.5% naman ang maling sagot sa pangungusap na "Kahapon ay umalis sila nang maaga."; at, 80 o 40% na wastong sagot at 120 o 60.5% na maling sagot sa pangungusap na "Aalis ako dahil uulan mamaya."; na pang-abay, nakakuha ng 120 o 60% na wastong sagot samantalang 80 o 40% naman ang maling sagot sa pangungusap na "Dapat na/iiwasan natin /ang labis na pagkain/ ng maaalat na pagkain."; 102 o 51% na wastong sagot at 98 o 49% na maling sagot sa pangungusap na "Tumakbo /ng / mabilis/ang manlalaro."; at, 108 o 54% na wastong sagot at 92 o 46% na maling sagot sa pangungusap na "Nagulat ako nang bumukas ang pinto nang may biglang nagsalita."; sa komposit ng iskor ng mga mag-aaral sa ayos ng mga salita sa pangungusap/sintaks, nakahihigit ang panuring at tinuturingan sa 71.83% na wasto ang sagot ng mga respondente, sinundan ito ng 53.11% sa pagtukoy sa bahagi ng panalita, at 44.25% ang timbangan ng salita o paralelismo samantalang sa maling sagot, nanguna ang timbangan ng mga salita o paralelismo sa 55.75%, sinundan ito ng pagtukoy sa bahagi ng panalita, at panghuli ang panuring at tinuturingan. Ang average na iskor ng mga mag-aaral sa pagsusulit sa ayos ng mga salita sa pangungusap/sintaks sa pagsukat sa antas ng kanilang kaalamang pangwika batay sa kraytirya ay 56.40 na may antas na Hindi Pasado ang Kaalaman**.** Sa Gamit ng Bantas sa Pangungusap naman, sa paggamit ng Tandang Padamdam, sa kabuoang 200 o 100% na respondente, nakakuha ng kabuoang iskor na 125 o 62.5% na wastong sagot samantalang 75 o 37.5% ang maling sagot sa pagtukoy sa bantas ng pangungusap na "Let us make pa-cute na lang!"; sa Tandang Pananong, sa pangungusap na "Anong wika ito?" ay nakakuha ng iskor na 160 o 80% ang wasto at 40 o 20% ang mali; sa "Hindi ba?" ay 145 o 72.5% ang wasto at 55 o 27.5% ang mali; at sa "Paano kaya nagsimula ang ganitong tipo ng mga pangungusap?" ay 120 o 60% ang wasto at 80 o 40% ang mali; sa Tuldok, sa tanong na "Resulta ito ng sobrang impluwesiya ng English sa Filipino (Pilipino, Tagalog)" ay 93 o 46.5% ang wasto at 142 o 71% ang mali; sa "Hindi niya ito kikilaning matinong pangungusap." ay 143 o 71.5% ang wasto at 57 o 28.5% ang mali; at sa "Ngunit suriin natin" ay nakakuha ng 112 o 56% ang wasto at 88 o 44% ang mali; sa Panaklong, sa tanong na ‘lalo na ng mga PROMDI (from the province)’, 13 o 6.5% ang wasto at 187 o 93.5% ang mali; sa ‘tinatawag na CPA (certified public atsay)’ ay 18 o 9% ang wasto at 182 o 90.5 ang mali; at sa 'ikaw ay tumawad naman, (Paglilipat) Tumawad ka naman, o‘ ay 49 o 24.5% ang wasto at 151 o 75.5% ang mali; sa Gitling, sa tanong na ‘anak-mayaman’ ay 34 o 17% ang wasto at 166 o 83 % ang mali; sa ‘mapag-class’ ay 53 o 26.5% ang wasto at 147 o 73.5% ang mali; sa ‘mag-asawa’ ay 27 o 13.5% ang wasto at 173 o 86.5% ang mali; at sa ‘pagtatanong-tanong‘ ay 126 o 63% ang wasto at 77 o 38.5% ang mali; sa Panipi, sa tanong na ”gibberish”, 57 o 28.55% ang wasto at 143 o 71.5% ang mali; sa 'Let us go na. They might think we are

making usap' ay 5 o 2.5% ang wasto at 97.5% ang mali; sa 'Sarili ba natin ang "make" sa let us make?' ay 6 o 3% ang wasto at 94 o 97% ang mali; sa 'Tiyak hindi maiintindihan ng monolinggwal na Amerikano ang let us make pa – cute na lang' ay 2 o 15% ang wasto at 198 o 99% ang mali; at 'o kaya'y isolate sentences' ay 109 o 54.5% ang wasto at 91 o 45.5% ang mali; sa Kuwit, sa tanong na 'Ang totoo, maraming kamag-anak ito.' ay 18 o 9% ang wastong sagot at 182 o 96% ang mali; 'sa kanyang mga tsimoy, tsimay, tsuper' ay 143 o 71.5% ang wasto at 157 o 28.5% ang mali; 'Malimit mangyari, lalo na kung wala sa bahay ang kanyang amo, na napipilitan siyang makipag-Inglesan' ay 95 o 47.55% ang wasto at 105 o 52.5% ang mali; at 'Pagpasok niya sa paaralan, may dala-dala na siyang uri ng wika na ang kalakhang bahagi ay natutuhan sa kanyang titser' ay 136 o 68% ang wasto at 64 o 32% ang mali; sa Elepsis, sa tanong na 'let us make....' ay 55 o 27.5% ang wasto at 145 o 72.5% ang mali; at, 'you make....' ay 2 o 1% ang wasto at 198 o 99% ang mali; at, sa Tutuldok, sa tanong na 'Ganito iyo: karaniwan nang hindi gaanong marunong ng English ang isang atsay.' ay 5 o 2.5% ang wasto at 195 o 97.5% ang mali; 'Ngunit maaaring itanong: alin ba ang namamarder sa dalawang wika?', 6 o 3% ang wasto at 194 o 97% ang mali; at 'tulad ng: Let us go na.', 6 o 3% ang wasto at 194 o 97% ang mali; sa komposit ng iskor ng mga mag-aaral sa gamit ng bantas, ng Tandang Padamdam, nakakuha ng kabuoang bahagdan na 62.5% na wastong sagot samantalang 37.5% ang maling sagot; ng Tandang Pananong, nakakuha ng kabuoang bahagdan na 70.83% na wastong sagot at 29.17% na maling sagot; ng Tuldok, nakakuha ng kabuoang bahagdan na 50.75% na wastong sagot at 49.25% na maling sagot; ng Panaklong, nakakuha ng kabuoang bahagdan na 13.33 % na wastong sagot at 86.50% na maling sagot; ng Gitling, nakakuha ng kabuoang bahagdan na 30% na wastong sagot at 70% na maling sagot; ng Panipi, nakakuha ng kabuoang bahagdan na 17.9% na wastong sagot at 82.1% na maling sagot; ng Kuwit, nakakuha ng kabuoang bahagdan na 49% na wastong sagot at 51% na maling sagot; ng Elepsis, nakakuha ng kabuoang bahagdan na 14.25% na wastong sagot at 85.75% na maling sagot; ng Kudlit, nakakuha ng kabuoang bahagdan na 24.5% na wastong sagot at 75.5% na maling sagot; at panghuli, at ng Tutuldok, nakakuha ng kabuoang bahagdan na 2.83% na wastong sagot at 97.17% na maling sagot, at ang antas ng kaalamang pangwika ng mga mag-aaral batay sa gamit ng bantas ay may average na 33.56 at may interpretasyong Hindi Pasado ang Kaalaman.

2. Na sa antas ng kahinaan/kahirapan ng mga mag-aaral sa kakayahang pangwika, nakakuha ng average na 82.55 at katumbas na antas na Mataas sa Karaniwang Kahusayan ang kaalaman ng mga mag-aaral sa wastong gamit ng mga salita, samantalang nakakuha naman ng average na 56.40 o antas na Hindi Pasado ang Kaalaman ng mga mag-aaral sa pagkilala ng ayos ng mga salita sa pangungusap /sintaks, at average na 33.56 o antas na Hindi Pasado ang Kaalaman ng mga mag-aaral sa Paggamit ng Bantas. Sa kabuoang average na 40.50, nangangahulugang Hindi Pasado ang kaalaman ng mga mag-aaral sa paksang kaalamang pangwika.

3. Na ang mananaliksik ay bumuo ng isang mungkahing babasahin na naglalaman ng mga aralin na makatutulong sa mga mag-aaral sa paglinang ng kasanayang pangwika. Ang mga aralin ay pinili at isinaayos at nakatuon sa gramatikang Filipino tulad ng wastong gamit ng mga salita na madalas mapagkamalian ng gamit o pagpalitin ng gamit sa pangungusap, pagbuo ng pangungusap na gamit ang mga bahagi ng panalita, at gamit ng bantas, at mga tuntunin nito na nalinang mula sa resulta ng pag-aaral. Ang babasahin ay maaaring dalhin sa lahat ng oras, magaang bitbitin at kaagad mapagsasanggunian kung kakailanganin.

KONGKLUSYON

Sa mga natuklasan ng pag-aaral, nabuo ng mananaliksik ang sumusunod bilang kongklusyon:

1. Nakahihigit ang kaalaman ng mga respondente, sa ilalim ng paggamit ng wastong mga salita, sa gamit ng ooperahin/ooperahan, subalit higit ang mali sa mga salitang subukin/subukan. Ang datos na ito ay bunga ng katotohanang Tagalog ang wikang lokal ng Cavite at ang mga salitang ooperahan at ooperahin ay mga salitang gamitin sa lugar, samantalang marami ang nagkamali sa mga salitang subukin at subukan sapagkat may iisang gamit lamang ito at malaya itong nakapagpapalitan sa lokal na pakikipagtalastasan; sa ayos ng mga salita sa pangungusap/sintaks, nakahihigit sa mga respondente ang natukoy nang wasto ang panuring at tinuturingan, samantalang higit sa mga respondente ang nakatukoy nang mali sa timbangan ng salita o paralelismo. Ang ganitong datos ay maiaangkla sa kalayaan ng kabataan sa bagong henerasyon sa pagsasalita at walang pagsaalang-alang sa kawastuhan; at sa wastong paggamit ng bantas, nakahihigit ang bahagdan ng pangangailangan ng pagkatuto ng mga mag-aaral sapagkat halos mahigit kalahati pa ng mga mag-aaral ang may kasalatan sa pagtukoy ng wastong bantas na dapat gamitin sa loob ng mga pangungusap.

2. Sa kahinaan/kahirapan ng mga mag-aaral sa kakayahang pangwika, higit ang pangangailangan na malunasan at mapaunlad ang gamit ng bantas sapagkat sa kraytiryang ito ay may antas na Hindi Pasado ang Kaalaman ng mga mag-aaral. Sa pagtukoy sa ayos ng mga salita sa pangungusap/sintaks, may antas ring Hindi Pasado ang Kaalaman ng mga mag-aaral. Samantala, sa pagtukoy sa wastong salitang gagamitin nagtamo ng antas na Mataas sa Karaniwang Kahusayan ang kaalaman ng mga mag-aaral, gayunpaman ay maaari pa rin itong pahusayin.

3. Ang disenyo ng babasahing panggramatika na iminumungkahi ng mananaliksik ay maihahalintulad sa pocketbook na maaaring dalhin saanmang lugar, anumang oras at anumang panahon na madadala sa bag ng mga mag-aaral at madaling mapagsasanggunian kung kakailanganin.

REKOMENDASYON

Batay sa mga nabuong konklusyon ay iminungkahi ng mananaliksik ang sumusunod:

Sa mga Mag-aaral ng Wika. Linangin pa ang kakayahang panggramatika at pag-ibayuhin pa ang kasanayang gramatikal sa Filipino. Bigyang-diin ang pagsasanay sa aspetong gramatikal na mahina at paunlarin pa ang aspetong may kalakasan. Sikaping magkaroon ng mga babasahing panggramatika na magagamit upang mapalakas ang mga aspetong mahina sa gramatika.

Sa mga Guro sa Filipino. Linangin pa ang kasanayang panggramatika sa Filipino ng mga mag-aaral upang higit silang maging mahusay; gumamit ng mga estratehiya sa pagtuturo ng wika na angkop sa kakayahan at kawilihan ng mga mag-aaral; magbalangkas ng mga aralin na makatutulong sa kasanayang panggramatika ng mga mag-aaral; magsagawa ng mga pagtataya para matiyak ang nalinang sa mga mag-aaral upang matuklasan kung gaano ang pagkatuto ng mga mag-aaral sa kasanayan o sa aralin matapos ang pagtuturo; malaman ang kahinaang dapat malapatan ng lunas at magamit ang resulta ng pagtataya sa pagsasagawa ng mga pagbabago sa pagtuturo at sa sarili; magsagawa pa ng mga pagsasanay sa mga mag-aaral sa aspetong mahirap sa kanila at bigyan diin ang mga bahagi ng panalita, pagbuo ng pangungusap at sa gamit ng bantas; at, magbigay sa mga mag-aaral ng mga kagamitan makatutulong sa pagpapaunlad ng kanilang gramatika sa tulad ng babasahing panggramatika sa Filipino

Sa mga Paaralan at Tagamahala. Magsagawa ng hakbang at mga paraan sa paglinang ng kahusayan at kakayahang panggramtika ng mga guro at mag-aaral; magsagawa at magbigay ng mga pagsasanay sa guro sa mga pamaraan at teknik sa pagtuturo ng gramatika

sa mga mag-aaral; hikayatin ang mga guro na magsagawa pa ng mga pag-aaral at pananalisik upang tuklasin ang mga kalakasan at kahinaan ng mga mag-aaral upang makagawa pa ng paraan para mapaunlad pa ang aspeto sa gramatika kung saan sila malakas at dapat na lunas sa aspeto ng gramatika na mahina sila; aglaan ng badyet sa mga kagamitan pampagtuturo na makatutulong sa mga guro at mag-aaral; hikayatin at pursigehin ang mga guro, higit iyon mga nasa elementarya at sekondarya na ituloy ang kanilang pag-aaral sa Filipino sa pagpapakadalubhasa upang magkaroon sila ng malawak na kaalaman, kahusayan at kasanayan sa gramatikang Flipino.

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POWER MEASUREMENT BY TWO (2) WATTMETER METHOD IN THE TOTALLY UNBALANCED THREE-PHASE POWER SYSTEM

Ricardo M. Peneyra

INTRODUCTION

Most of the textbooks, reviewers and other related materials in the polyphase circuit, specifically on the power measurement in three phase power system by two (2) wattmeter method concentrated only to the following:

1. Balanced three-phase load connected to/supplied by balanced three-phase voltage source.

2. Unbalanced three-phase load connected to/supplied by balanced three-phase voltage source.

As a veteran reviewer for 32 years in the EE Licensure Examination, an EE educator for 35 years and a practitioner in the field for quite long time, the researcher have noticed that **nothing** was discussed in any textbook that he have read, local or foreign, about the power measurement in the totally unbalanced three-phase power system or in the other sense he feel that no author of Electrical Engineering textbook dared to discuss if power measurement by two (2) wattmeter method is still valid/applicable to unbalanced three-phase load connected to/supplied by unbalanced three-phase voltage source.

For so many years, the researcher have been thinking of the reasons why these authors have failed to discuss the subject he have mentioned earlier and this attitude of them (author/writer) makes him (researcher) very curious about this (subject) because this is what is usually happening in the real world. So he decided that it is very high time to determine if the two (2) wattmeter method is also valid to the totally unbalanced three-phase power system, which is the primary purpose of this study.

STATEMENT OF THE PROBLEM / OBJECTIVE OF THE STUDY

This study aims to verify the following:

1. The validity of the two (2) wattmeter method of power measurement in the totally unbalanced three-phase power system or unbalanced three-phase load connected to/supplied by unbalanced three-phase voltage source.

2. The validity of Tellegen's Theorem in Polyphase Power System, specifically in the totally unbalanced three-phase power system.

RESEARCH METHOD

Two problems with three (3) possible wattmeter connections in each wherein each wattmeter connection constitute one question which is originally made by the researcher are used in this study.

The first problem consist of unbalanced three-phase wye (Y) connected load supplied by unbalanced three-phase CBA/(-) sequence voltage source while the second problem consist of unbalanced delta(∆) connected load supplied by unbalanced three-phase ABC/(+) sequence voltage source. For complete details of the problems, their solutions and their answers, please refer to appendices.

In the first and second problems, the three (3) possible connections of the two (2) wattmeter to the circuit are made with the power absorbed by the unbalanced three-phase load, in watts, as the experimental value (EV) and the sum of the two (2) wattmeter readings, in watts also, as the true value (TV). True values (TV) and Experimental values (EV) are compared to each other by taking their positive (+) or negative (-) differences. Differences in watts were taken as errors and % error was computed using the formula;

$$\% \text{ Error} = \frac{TV-EV}{TV} \; X \; 100$$

With an allowable per cent (%) error of ±1% as an acceptable value as provided by the researcher.

CONCLUSIONS

Based on the findings of the study the following conclusions were hereby drawn:

1. Power measurement by two (2) wattmeter method is also very valid to the totally unbalanced three-phase power system or unbalanced three-phase load connected to/supplied by unbalanced three-phase voltage source.

2. Tellegen's Theorem which states that "In any electric circuit the power delivered by the source is equal to the power absorbed by the load", is also very valid in the totally unbalanced three-phase power system.

RECOMMENDATIONS

1. Include mandatory the subject as a topic in polyphase system specifically in three-phase power system by:

   a. Authors/Writers

   b. EE Educators

2. Conduct further studies on the validity of the subject to reactive power measurement in the totally unbalanced three-phase power system by two (2) varmeter method.

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APPENDICES

Two problems in totally unbalanced three-phase power system originally made by the researcher consisting of three possible wattmeter connections in a three-phase circuit.

PROBLEM I

Given: Unbalanced Three-Phase voltages, CBA/(-) sequence.

V_{AB} = 220 ∠30º volts

V_{BC} = 240 volts

V_{CA} = 208 volts

Load: Unbalanced Y – connected load

Z_{AO}= 8 ∠0ºΩ

Z_{BO} =12 ∠45ºΩ

Z_{CO} = 6 ∠-30ºΩ

Solve for the total true power drawn by the Three-Phase load and compare it to the sum of the two (2) wattmeter readings using the three (3) possible connections of the wattmeter.

Solutions:

According to P.Pillay and M.Manyage (2001), unless there is a fault in the power system the sum of the line voltages in a three-phase system whether balanced or unbalanced is zero, then by solving the phase angle of the given voltages we get

V_{AB} = 220 ∠30º volts

V_{BC} = 240 ∠156.45ºvolts

V_{CA} = 208 ∠-81.85º volts

Converting the unbalanced Y-connected load to unbalanced ∆-connected load we get

Z_{AB} = 31.6 ∠49.25º Ω

Z_{BC} = 23.7 ∠19.25º Ω

Z_{CA} = 15.8 ∠-25.75º Ω

Power Absorbed (EV) = $(I_{AA})^2(R_{AO}) + (I_{BB})^2(R_{BO}) + (I_{CC})^2(R_{CO})$

$= (8.66)^2 (8\cos 0º) + (16.74)^2 (12\cos 45º) + (23.14)^2 [6\cos(-30º)]$

= 5,760.11 watts

Solving for the phase currents, I_{AB}, I_{BC} & I_{CA} we get,

$I_{AB} = \frac{Vab}{Zab} = \frac{220\angle 30°}{31.6\angle 49.25°}$ = 6.96 ∠-19.25° amperes

$I_{BC} = \frac{Vbc}{Zbc} = \frac{240\angle 156.45°}{23.7\angle 19.25°}$ = 10.13 ∠137.2° amperes

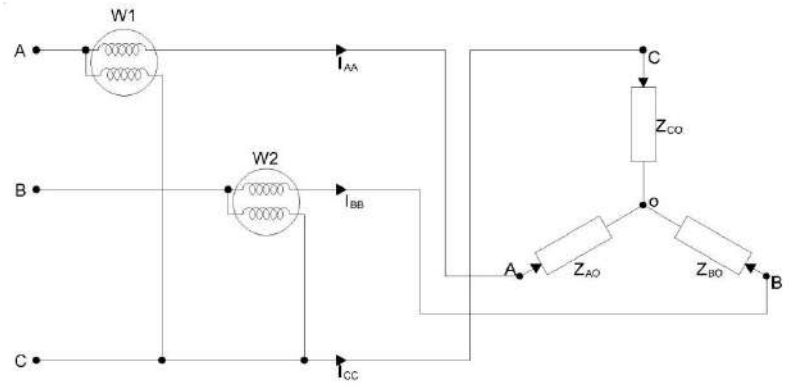
$I_{CA} = \frac{Vca}{Zca} = \frac{208\angle -81.85°}{15.8\angle -25.75°}$ = 13.16 ∠-56.1° amperes

$I_{AA} = I_{AB} - I_{CA}$ = 6.96 ∠-19.25° - 13.16 ∠-56.1° = 8.66 ∠95.094° amperes

$I_{BB} = I_{BC} - I_{AB}$ = 10.13 ∠137.2° - 6.96 ∠-19.25° = 16.74 ∠146.761° amperes

$I_{CC} = I_{CA} - I_{BC}$ = 13.16 ∠-56.1° - 10.13 ∠137.2° = 23.14 ∠-50.319° amperes

1. First Possible Wattmeter Connections



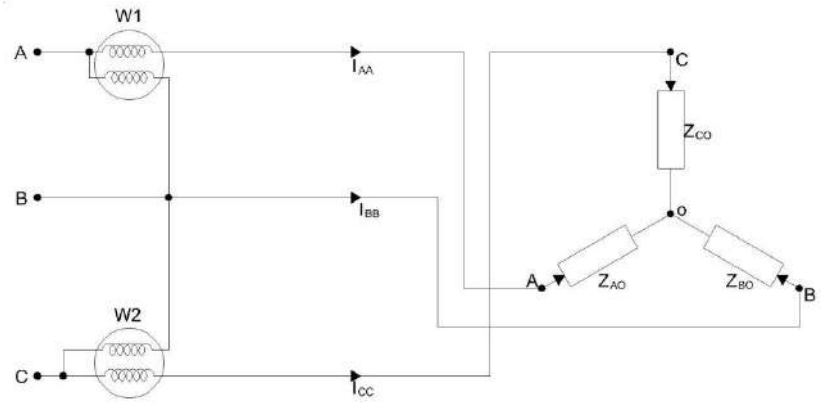
$W_1 = (V_{AC})(I_{AA}) \cos \propto] = (208)(8.66) \cos (180° - 81.85° - 95.094°)$
W_1 = 1,798.72 watts

$W_2 = (V_{BC})(I_{BB}) \cos \beta] = (240)(16.74) \cos (156.45° - 146.761°)$
W_2 = 3,960.29 watts

Power Delivered (TV) = $W_1 + W_2$ = 1,798.72 + 3,960.29 = 5,759.01 watts

% Error = $\frac{TV-EV}{TV} X\ 100 = \frac{5,759.01-5,760.11}{5,759.01} X\ 100$ = -0.019%

2. Second Possible Wattmeter Connections



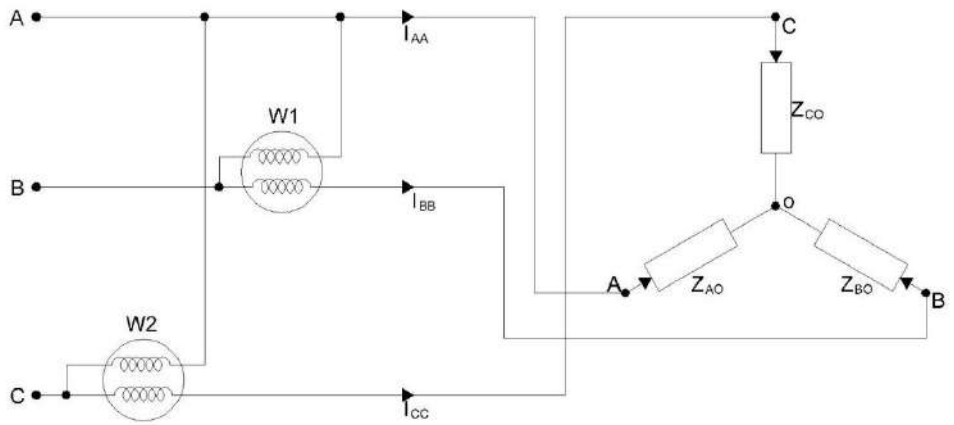
$W_1 = (V_{AB})(I_{AA}) \cos \propto] = (220)(8.66) \cos (95.094° - 30°)$
$W_1 = 802.34$ watts

$W_2 = (V_{CB})(I_{CC}) \cos \beta] = (240)(23.14) \cos [50.319° - (180°-156.45°)]$
$W_2 = 4958.42$ watts

Power Delivered (TV) = $W_1 + W_2 = 802.34 + 4958.42 = 5{,}760.76$ watts

% Error = $\frac{TV-EV}{TV} X\ 100 = \frac{5{,}760.76 - 5{,}760.11}{5{,}760.76} X\ 100 = 0.011\%$

3. Third Possible Wattmeter Connections



$W_1 = (V_{BA})(I_{BB}) \cos \propto] = (220)(16.74) \cos [30° + (180°-146.761°)]$
$= 1{,}658.25$ watts

$W_2 = (V_{CA})(I_{CC}) \cos \beta] = (208)(23.14) \cos (81.85°-50.319°)$
$= 4{,}102.50$ watts

Power Delivered (TV) = $W_1 + W_2 = 1{,}658.25 + 4{,}102.50 = 5{,}760.75$ watts

% Error = $\frac{TV-EV}{TV} X\ 100 = \frac{5{,}760.75 - 5{,}760.11}{5{,}760.75} X\ 100 = 0.011\%$

PROBLEM II

Given: Unbalanced Three-phase voltages, ABC/(+) sequence.

V_{AB} = 450 volts

V_{BC} = 400 volts

V_{CA} = 380 volts

Load: Unbalanced Δ – connected load

Z_{AB}= 10 ∠0ºΩ

Z_{BC} =20 ∠45ºΩ

Z_{CA} = 15 ∠-30ºΩ

Solve for the total true power drawn by the Three-phase load and compare it to the sum of the two (2) wattmeter readings using the three (3) possible connections of the wattmeter.

Solutions:

According to P.Pillay and M.Manyage (2001), unless there is a fault in the power system the sum of the line voltages in a three-phase system whether balanced or unbalanced is zero, then by solving the phase angle of the given voltages we get

V_{AB} = 450 ∠0° volts

V_{BC} = 400 ∠-127.29° volts

V_{CA} = 380 ∠123.13° volts

Solving for the phase currents $I_{AB,}$ I_{BC} & I_{CA} we get,

$I_{AB} = \frac{Vab}{Zab} = \frac{450\angle 0°}{10\angle 0°}$ = 45∠0° amperes

$I_{BC} = \frac{Vbc}{Zbc} = \frac{400\angle -127.29°}{20\angle 45°}$ = 20∠-172.29° amperes

$I_{CA} = \frac{Vca}{Zca} = \frac{380\angle 123.13°}{15\angle -30°}$ = 25.33∠153.13° amperes

$I_{AA} = I_{AB} – I_{CA}$ = 45∠0°- 25.33∠153.13° = 68.56∠-9.61° amperes

$I_{BB} = I_{BC} – I_{AB}$ = 20∠-172.29° - 45∠0° = 64.87∠-177.63° amperes

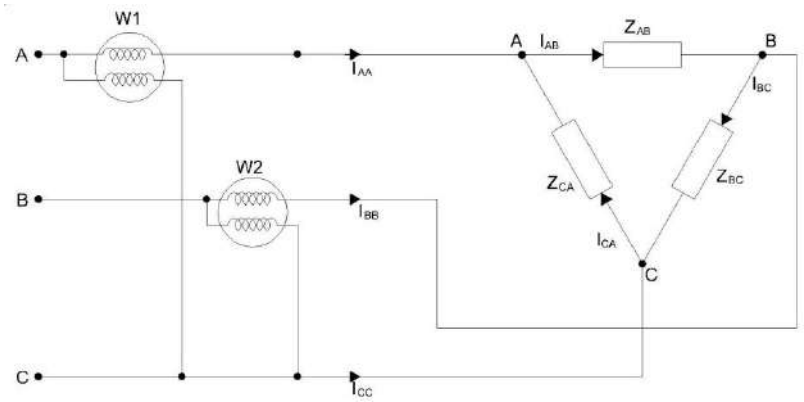
$I_{CC} = I_{CA} – I_{BC}$ = 25.33∠153.13° - 20∠-172.29° = 14.4∠101.11° amperes

Power Absorbed (EV) = $(I_{AB})^2(R_{AB}) + (I_{BC})^2(R_{BC}) + (I_{CA})^2(R_{CA})$

= $(45)^2$ (10cos0º) + $(20)^2$ (20cos45º) + $(25.33)^2$ [15cos(-30º)]

= 34,241.60 watts

1. First Possible Wattmeter Connections



$W_1 = (V_{AC})(I_{AA}) \cos \propto] = (380)(68.56) \cos [(180°\text{-}123.13°) – 9.61°]$

= 17,681.32 watts

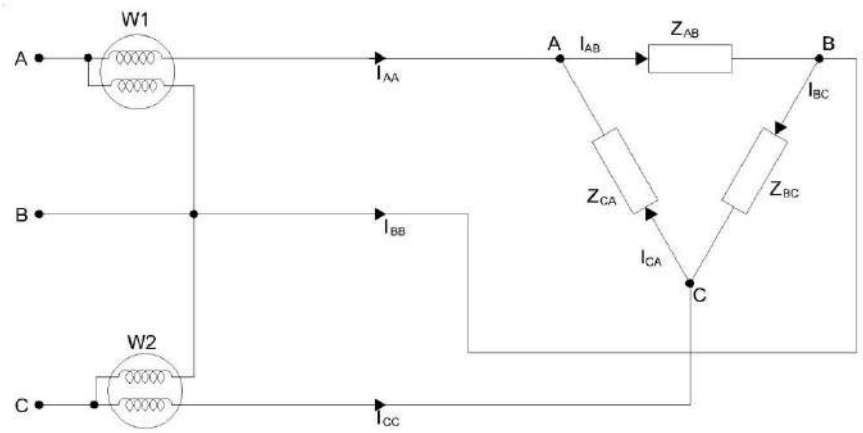
$W_2 = (V_{BC})(I_{BB}) \cos \beta] = (400)(64.87) \cos (177.63°\text{-}127.29°)$

= 16,560.81watts

Power Delivered (TV) = $W_1 + W_2$ = 17,681.32 + 16,560.81= 34,242.13 watts

% Error = $\frac{TV-EV}{TV} X\ 100 = \frac{34{,}242.13\ -34{,}241.60}{34{,}242.13} X\ 100$ = 0.0016%

2. Second possible wattmeter connections



$W_1 = (V_{AB})(I_{AA}) \cos \propto] = (450)(68.56) \cos(9.61°)$

= 30,419.05 watts

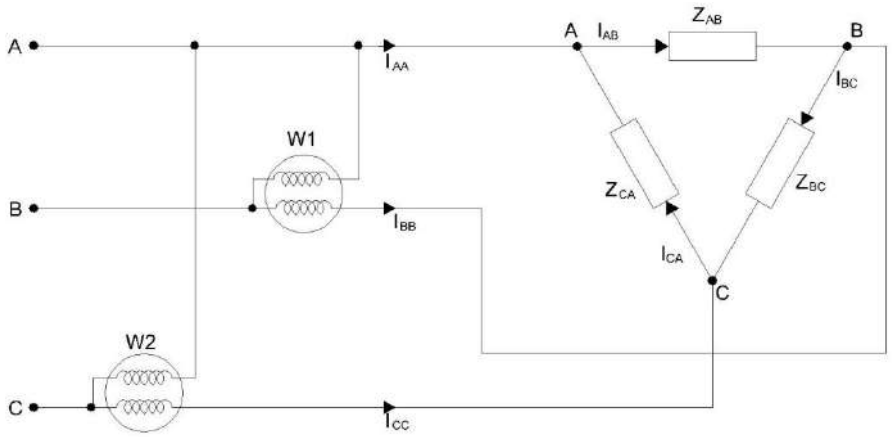
$W_2 = (V_{CB})(I_{CC}) \cos \beta\ ] = (400)(14.4) \cos [101.11° - (180° - 127.29°)]$

$= 3{,}824.22$ watts

Power Delivered (TV) = $W_1 + W_2 = 30{,}419.05 + 3{,}824.22 = 34{,}243.27$ watts

% Error = $\frac{TV-EV}{TV} X\ 100 = \frac{34{,}243.27 - 34{,}241.60}{34{,}243.27} X\ 100 = 0.005\%$

3. Third possible wattmeter connection



$W_1 = (V_{BA})(I_{BB}) \cos \propto\ ] = (450)(64.87) \cos(180° - 177.63°)$

$= 29{,}166.53$ watts

$W_2 = (V_{CA})(I_{CC}) \cos \beta\ ] = (380)(14.4) \cos (123.13° - 101.11°)$

$= 5{,}072.83$ watts

Power Delivered (TV) = $W_1 + W_2 = 29{,}166.53 + 5{,}072.83 = 34{,}239.36$ watts

% Error = $\frac{TV-EV}{TV} X\ 100 = \frac{34{,}239.36 - 34{,}241.60}{34{,}239.36} X\ 100 = -0.0065\%$

Behavioral Research

ASSESSMENT TO THE EARIST THRUST COURSE PROGRAM THAT OFFERS EXTENSION ACTIVITY SERVICES: A SOURCE OF PLANNING AND BUDGETING A VIABLE EXTENSION CAPABILITY PLAN

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Prof. Herbert D. Vertucio
Prof. Evelyn M. Polison
Prof. Angela M. Caaya

INTRODUCTION

The school being a storage, generator and disseminator of knowledge, should make an impact on the community within its reach. Although its graduates will naturally be involved in the development of the community where they work and live, there are a lot more people who were not able to have formal university training, and need outside help to make them productive members of the community

It is in this light that the university has the College Extension Evaluation Committee (CEEC). This office acts as the university's arm in directly reaching out to the people in the community who need help – technical, financial, and moral - to improve their living conditions. This mandate is carried out by means of programs, like: training and non-formal education for Non-government organization (NGO's), People's Organization (POs), and individuals. This is done through non-degree training programs, extending technical assistance, and extending financial assistance, if possible.

Through extension, the university shall contribute to the development of empowered citizenry capable of making rational decisions pertaining to the improvement of their livelihood, work productively and efficiently, and be a confident part of the mainstream society in their community.

On the other hand, a well-designed program can have differing levels of success depending on the quality and quantity of implementation. If only a portion of a program was delivered as designed, it is reasonable to anticipate that only a portion program's content is present but lacks high quality delivery as intended by program designers, implementation value and corresponding outcomes can, and often do, suffer (Mihalic, Fagan & Argamaso, 2008). Likewise, the characteristics of a program may also influence levels of program implementation. If a program is too complex, too lengthy, or inappropriate for the population being served, the likelihood of a program being delivered as designed maybe low (Pereplectchikova, Treat, & Kazdin, 2007). Furthermore, extension programs are designed inherently for the community they are serving by addressing "the problems, issues, concerns of local communities" (Garst & McCawley, 2015, p. 27). Thus, if a program is not tailored to a local group, the quality to which it is implemented may suffer (Arnold, 2015).

The program development models used by Extension professionals often rely on the approach and simplicity of use of the model. Tyler's (1949) approach is a classic model most often used directly or as the basis for all program development models. For example, Tyler's (1949) four programming questions can be directly cross-walked with the planning model presented by Seevers and Graham (2012) and the logic model (University of Wisconsin – Extension, 2003). Boone, Safrit, and Jones's (2002) model is the most comprehensive and complex of the models used by those wanting to address programming from a systems perspective. Boyle (1981), Caffarella and Ratcliff Daffron (2013), and Klein and Morse's (2009)

models are attractive to Extension professionals who prefer a micro and simplified approach to program development (i.e., a checklist of specific actions), while Cervero and Wilson's (2006) model appeals to Extension professionals who value programming with social justice goals. The interests of Extension professionals and their programming context, including their organizational history, tend to determine which program model or models they use to guide their educational efforts.

RESEARCH FOCUS

Figure 1. Research Paradigm of the Study

Several authors (Garst, Hunnings, Jamison, Hairston, & Meadows, 2007; Maddy et al., 2002) have made the case for highly competent professionals being critical to the future of Extension. Based on recent research with Cooperative Extension directors, the Extension Committee on Organization and Policy (2007) suggested improving the quality and skills of Extension professionals as one strategy for transforming Cooperative Extension. Given the concerns about talented employees, it is recommended that Extension systems assess their human resource management practices using the competencies to inform efforts in hiring, professional development, and other key functions. At the same time, academic extension education programs should examine their curricular requirements and implement updates and revisions as needed.

This study gives emphasis to the EARIST Training Services Program that is thrust Funded and non-thrust funded that signify to skills development program, community education and entrepreneurship training program embodied to the different colleges of EARIST such as Engineering, Industrial technology, business administration, arts and sciences, education, hospitality management, public administration and criminology, and architecture and fine arts which is possible also thru donor, benefactors and alumni support.

THEORETICAL FRAMEWORK

The present study adopted the theory on how to reform system and improve it permanently (Spanbauer, 2006). This shakes the very foundation of institution or system by restructuring the way of management on the quality approach which determines the long run success or failures of the institution. High quality services can provide the institutions with a competitive advantage since it increases productivity, profits and other related measures of success.

Most importantly, high quality approach not only generates satisfied customers but the continuity of patronizing with positive and favorable word-of-mouth advertising. This quality approach depends on excellence in the delivery of quality assurance services through quality management approaches like continuous monitoring, and reengineering which involves commitment to reviewing and reengineering all policy aspects in transforming the quality assurance services of the culture of a certain institutions.

In this view, the present study categorizes that the EARIST Extension Training Services Program needs a Quality Assurance Services that consider the transparency, reengineering, commitment, monitoring, restructuring, and managing of the increase productivity of the extension programs in more sustainable and viable category in attaining great extent of success as Educational Institution. The quality product pertaining to the services offered by the institution through collaborative efforts of students, professors and administrators intensified high degree performances of the clienteles thru restructured management for quality transfer of learning, transfer of technology and transfer of equitable and competitive productivity of the community.

RESEARCH QUESTIONS

This study aimed to assess the thrust course program that offers extension activity services for planning and budgeting a viable extension capability plan. In the light of the foregoing study, it sought to answer the following questions:

1. What is the Thrust of the EARIST Programs that are funded?

2. How EARIST Extension Training Services Plan and Budget Allocated?

3. What are the EARIST Extension Training Services Program offered to the clientele in terms of Skills Development Program; Entrepreneurship Training Program; and Community Education?

4. How do the respondents assess the EARIST Extension Services Program in terms of Extension Program Design; Resource Experts; Facilities; and Advisory or Training Services?

5. What is the most extent of financial dissemination criteria does the EARIST Extension Training Services Program were done?

6. How EARIST Extension Training Services Program give benefit to the clienteles?

7. How the evident EARIST Extension Training Services Program sustainable and viable?

8. Using the result, What Source of Planning and Budgeting of Viable Extension Capability Plan may be proposed?

RESEARCH METHOD

This study made use of the descriptive design to assess the thrust course program that offers extension activity services for planning and budgeting a viable extension capability plan.

This method focuses on the present condition that find new truth pertaining to the increase of quantity of knowledge, a new generation or new law, increase insights into factors which are operating, and a new accurate formation of the problem to be solved and many others pertaining to the EARIST Training Service Program.

A purposive sampling (Alteras, 2005) was used in this study. Purposive sampling is a non-random or non-probability sampling which plays a major role in the selection of particular item and/or in making decisions in cases of incomplete responses or observation that usually based on a certain criteria. The clienteles are utilized to ensure a wide and in-depth assessment of the EARIST thrust course program that offers extension activity services.

On the other hand, the conceptualized questionnaires was used which validated by the experts in order to successfully comprehend the Extension Services Programs of EARIST which comprise into different parts such as Part I, the allocated Colleges that are thrust and funded; Part II, allocation of EARIST Plan and Budget; Part III, the EARIST Extension Training Services Program that offered to the community and society that categorize into Skills Development Program, Entrepreneurship Training Program and Community Educational Program; Part IV, assessments of the extension clienteles regarding Extension Training Services Programs in terms Extension Program Design, Resource Experts, Facilities and Advisory or Training Services.

This study also rely quantitatively with respect to the use of statistic manner such as (1) weighted mean, this was used to get the average of frequency of the responses in each

weighted item of the specific problem no. 4 with scale of 5 (4.50-5.00) Best, 4 (3.50-4.49) Better, 3 (2.50-3.49) Good, 2 (1.50-2.49) Fair and 1 (1.00-1.49) Poor.

Meanwhile, a qualitative research was used to gain an understanding of underlying reasons, opinions, and motivations. It provides insights into the problem or helps to develop ideas or hypotheses for potential quantitative research that pertains to answer the sub-problems number 1, 2, 3, 5, 6 and 7 in order to conceptualize a Comprehensive Source of Planning and Budgeting of Viable Extension Capability Plan of EARIST concerning with the EARIST thrust and non-thrust educational programs.

RESULTS AND DISCUSSION

The following are the findings of the specific problems raised in the study:

1. What is the Thrust of the EARIST Programs that are funded?

Since, EARIST is an institution of Science and Technology which consists of eight (8) colleges with different programs, the specific programs of the EARIST Thrust are College of Engineering and College of Industrial Technology that offered high extent of further studies in upgraded Science and Technology with extravagant source of transfer of technology with its clienteles thru experts.

2. How EARIST Extension Training Services Plan and Budget Allocated?

In accordance with the Commission on Higher Education (CHED) Memorandum Order No. 20 series of 2011 under section 10 pertains to Budget Allocation for Extension Services state that the third major function of the State Universities and Colleges (SUC) is extension services, which primarily includes the dissemination of the research output for the use and benefit of the community or locality in which the SUC is located.

Furthermore, the budget allocation shall be used for instructional materials necessary for effective technology transfer of research outputs to the community, skills training in livelihood relative to the research output, honoraria of trainers undertaking the technology transfer of research outputs to the community, travel, training and seminar of extensions services personnel, trainers' industry immersion program, wages of contract of service personnel other services (job order). Expenses incurred in undertaking the secondary function of extension services which includes alternative learning system (outreach program), skills training and development in consortium with local government units involving human resource development and other similar activities may likewise be included in the budget for this function.

Based on the Proposed Program of Expenditures-General Fund of EARIST, there is appropriation of P 8, 480, 000.00 which inculcate an allotment of P 5, 280, 000.00 pertaining to personal services (RATA and Honoraria), MOOE expenses such as travelling, trainings, communication, supplies and materials awards and incentives, printing and publication, extension journal and manual, conduct of tracer study, membership, representation, extension and community outreach activities, equipment outlay and repair of extension program.

On the other hand, it also stipulated to the Proposed Program of Expenditures-General Fund of EARIST that Extension and Community /outreach Activities has an appropriation of P 3, 500, 000.00 which is allotted only a figure of P 1, 800,000.00.

But on the other hand, based on the submitted Accomplishment Reports of the eight (8) colleges last 2015, it is observed that there is limited financial plan and budget implemented in all levels of the institution especially to the EARIST Thrust programs such as Engineering and Industrial Technology. Moreover, most of the extension training services programs are shoulder by the students and professors in order to come up with feasible and more reliable extension activities. Indeed, some activities are sponsored by non-government organizations and other foundations.

3. What are the EARIST Extension Training Services Program offered to the clientele last 2015 in terms of Skills Development Program; Entrepreneurship Training Program; and Community Education?

Table 1: EARIST Extension Training Services Program offered last 2015

Name of Colleges offering Extension Services	EARIST EXTENSION TRAINING SERVICES PROGRAM 2015		
	Skills Development Programs	**Entrepreneurship Training Program**	**Community Education**
College of Engineering (CEN)	------	------	1.Values Formation 2. Institute Disaster Risk Reduction Training
College of Industrial Technology (CIT)	------	------	1.Disaster Preparedness 2. Institute Disaster Risk Reduction Training 3.Brgy.Pinagkaisahan Disaster Preparedness and Response Training
College of Arts and Sciences (CAS)	------	------	1.Institute Disaster Risk Reduction Training 2. Math-tuto at maging Math-tinik 3.Math-alas na Kabataan
College of Business Administration (CBA)	------	1.Community Credit Cooperative	1. Institute Disaster Risk Reduction Training
College Architecture and Fine Arts (CAFA)	------	------	1. Institute Disaster Risk Reduction Training
College of Hospitality Management (CHM)	1.Food and Beverages Skills 2.Sandwich making	------	1. Institute Disaster Risk Reduction Training
College of Education (CED)	1.Taho Making	1.Nutrition and Health Wellness 2.Veggie and Patty Burger	1.Tutorial on Mathematics 2.Team Building (Enhancing Skills in Alternative Mathematics) 3.Tutorial Pictograph 4.Familliarization of Different words and story teller 5. Box to Basic 6.Phonic Sounds 7.Jigsaw Reading 8.Pagbasa at Pagsulat 9.Pagguhit 10. Kagandahang Asal at Tamang Pagbigkas ng Salita 11.Pagkukwento ng ibat-inang akda 12. Institute Disaster Risk Reduction Training
College of Public Administration and Criminology (CPAC)	------	------	1.Institute Disaster Risk Reduction Training

The EARIST Extension Training Services Program for the year 2015 strikes a nonstop extension activities which is observed and categorized to twenty-three (23) Community Education Programs, three (3) Skills Development Programs and another three (3) Entrepreneurship Training Programs. This scenario implicated that all Extension Training Services Program manifests transfer of learning only. While in fact, it should be in the inheritance of the institution to engage Extension Training Programs which are sustainable and viable that are responsive to the society and community thru technology transfer, skills training in livelihood, travel, training and seminar of extensions services personnel, immersion program in industry and a like.

4. How do the respondents assess the EARIST Extension Services Program in terms of:

4.1 Extension Program Design;

Table 2: Assessment of the Respondents in the EARIST Extension Services Program in Terms of Extension Program Design

		EARIST EXTENSION SERVICES PROGRAM																						
		SDP			CEP																ETP			
	Criteria	TM	FBS	SM	DP	TuM	TB	TP	FDWST	B2B	PS	JR	P&P	P	KATPS	PIA	VF	IDRRT	BPDPRT	MMM	MK	NHW	VPB	CCC	TOTAL
1	There is a relevant and appropriate extension program design responsive to Extension VMGO.	4.25	4.24	4.21	4.28	4.28	4.27	4.26	4.28	4.27	4.29	4.22	4.28	4.28	4.27	4.26	4.26	4.27	4.26	4.29	4.27	4.28	4.29	4.28	**4.27**
2	There is a clear and specific path of extension program design fitted to the clientele.	4.28	4.26	4.25	4.27	4.25	4.25	4.28	4.25	4.27	4.27	4.27	4.26	4.29	4.25	4.23	4.24	4.28	4.25	4.25	4.27	4.28	4.26	4.25	**4.26**
3	There is an appropriate execution of the extension program design between and among the clienteles and extensionist.	4.27	3.88	4.27	4.25	4.27	4.24	4.26	4.28	4.24	4.28	4.25	4.27	4.26	4.26	4.24	4.24	4.27	4.22	4.29	4.26	4.26	4.28	4.28	**4.24**
4	The extension program design contains a topical sequence and proper order.	4.26	4.27	4.28	4.27	4.27	4.28	4.27	4.26	4.28	4.25	4.26	4.25	4.27	4.28	4.25	4.26	4.28	4.27	4.26	4.27	4.25	4.28	4.28	**4.27**
5	There is an Implementation of congruent and parallel methodologies in the execution of Extension Program Design.	4.25	4.28	4.28	4.26	4.26	4.28	4.26	4.26	4.28	4.25	4.29	4.28	4.26	4.27	4.29	4.28	4.27	4.22	4.29	4.27	4.28	4.27	4.27	**4.27**
	TOTAL	**4.26**	**4.19**	**4.26**	**4.27**	**4.27**	**4.26**	**4.27**	**4.27**	**4.27**	**4.27**	**4.26**	**4.27**	**4.27**	**4.27**	**4.25**	**4.26**	**4.27**	**4.24**	**4.28**	**4.27**	**4.27**	**4.28**	**4.27**	**4.26**

Legend:

SDP - Skills Development Program
CEP - Community Education Program
ETP - Entreprenuership Training Program
NHW - Nutrition and Health Wellness
TM - Taho Making
DP - Disaster Preparedness
VPB - Veggie and Patty Burger
TuM - Tutorial on Mathematics
TB - Team Building (Enhancing Skills in Alternative Mathematics)
TP - Tutorial Pictograph
FDWST-Familiarization of Different Words and Story Telling
B2B - Box to Basic
PS - Phonic Sounds
JR - Jigsaw Reading
P&P - Pagbasa at Pagsulat
P – Pagguhit
KATPS - Kagandahang Asal at Tamang Pagbigkas ng Salita
FBS - Food and Beverages Skills
SM - Sandwich Making
VF - Values Formation
CCC - Community Credit Cooperative
IDRRT - Institute Disaster Risk Reduction Training
BPDPRT - Brgy. Pinagkaisahan disaster Preparedness and Response Training
MM - Math-tuto at maging Math-tinik
MK - Math-alas na Kabataan

The EARIST Training Services Program containing Skills Development Program, Community Education Program and Entrepreneurship Training Program is evidently better extension program in terms of Extension Program Design garnering a weighted mean of 4.29.

The program development models used by Extension professionals often rely on the approach and simplicity of use of the model. Tyler's (1949) approach is a classic model most often used directly or as the basis for all program development models. For example, Tyler's (1949) four programming questions can be directly cross-walked with the planning model presented by Seevers and Graham (2012) and the logic model (University of Wisconsin – Extension, 2003). Boone, Safrit, and Jones's (2002) model is the most comprehensive and complex of the models used by those wanting to address programming from a systems perspective. Boyle (1981), Caffarella and Ratcliff Daffron (2013), and Klein and Morse's (2009) models are attractive to Extension professionals who prefer a micro and simplified approach to program development (i.e., a checklist of specific actions), while Cervero and Wilson's (2006) model appeals to Extension professionals who value programming with social justice goals. The interests of Extension professionals and their programming context, including their organizational history, tend to determine which program model or models they use to guide their educational efforts.

4.2 Resource Experts;

Table 3: Assessment of the Respondents in the EARIST Extension Services Program in Terms of Resource Experts

		EARIST EXTENSION SERVICES PROGRAM																							
		SDP			CEP																		ETP			
	Criteria	TM	FBS	SM	DP	TuM	TB	TP	FDWST	B2B	PS	JR	P&P	P	KATPS	PIA	VF	IDRRT	BPDPRT	MMM	MK	NHW	VPB	CCC	TOTAL
1	There is a competent, qualified and professionally trained extensionist.	4.39	4.36	4.39	4.36	4.35	4.38	4.38	4.37	4.37	4.4	4.39	4.37	4.38	4.36	4.33	4.4	4.37	4.38	4.35	4.31	4.38	4.38	4.33	**4.37**
2	The resource experts present the extension program in clear manner.	4.38	4.37	4.32	4.37	4.36	4.35	4.36	4.33	4.35	4.37	4.31	4.35	4.36	4.36	4.35	4.35	4.33	4.23	4.38	4.33	4.35	4.35	4.32	**4.34**
3	The resourse experts provide extensive and well-organized presentation and execution of extension program.	4.35	4.35	4.37	4.37	4.38	4.37	4.36	4.32	4.35	4.33	4.37	4.38	4.36	4.31	4.38	4.37	4.4	4.38	4.37	4.38	4.39	4.33	4.35	**4.36**
4	The resource experts used appropriate methodologies for learning skills capability.	4.4	4.38	4.33	4.38	4.34	4.32	4.37	4.4	4.35	4.37	4.36	4.34	4.38	4.4	4.38	4.39	4.32	4.39	4.35	4.38	4.38	4.38	4.38	**4.37**
5	The resource experts uses practical training aids that are effective, efficient and suitable in the skills development capability of the clienteles.	4.38	4.35	4.38	4.4	4.38	4.37	4.36	4.37	4.38	4.39	4.39	4.33	4.37	4.39	4.37	4.38	4.38	4.37	4.4	4.36	4.4	4.33	4.39	**4.37**
	TOTAL	**4.38**	**4.36**	**4.36**	**4.38**	**4.36**	**4.36**	**4.37**	**4.36**	**4.36**	**4.37**	**4.36**	**4.35**	**4.37**	**4.36**	**4.36**	**4.38**	**4.36**	**4.35**	**4.37**	**4.35**	**4.38**	**4.35**	**4.35**	**4.36**

Legend:

SDP - Skills Development Program
CEP - Community Education Program
ETP - Entreprenuership Training Program
NHW - Nutrition and Health Wellness
TM - Taho Making
DP - Disaster Preparedness
VPB - Veggie and Patty Burger
TuM - Tutorial on Mathematics
TB - Team Building (Enhancing Skills in Alternative Mathematics)
TP - Tutorial Pictograph
FDWST-Familiarization of Different Words and Story Telling
B2B - Box to Basic
PS - Phonic Sounds
JR - Jigsaw Reading
P&P - Pagbasa at Pagsulat
P – Pagguhit
KATPS - Kagandahang Asal at Tamang Pagbigkas ng Salita
FBS - Food and Beverages Skills
SM - Sandwich Making
VF - Values Formation
CCC - Community Credit Cooperative
IDRRT - Institute Disaster Risk Reduction Training
BPDPRT - Brgy. Pinagkaisahan disaster Preparedness and Response Training
MM - Math-tuto at maging Math-tinik
MK - Math-alas na Kabataan

There are better execution of Extension Training Services Program through the used facilities as to Skills Development, Community Education and Entrepreneurship Training obtaining a mean value of 4.19.

Several authors (Garst, Hunnings, Jamison, Hairston, & Meadows, 2007; Maddy et al., 2002) have made the case for highly competent professionals being critical to the future of Extension. Based on recent research with Cooperative Extension directors, the Extension Committee on Organization and Policy (2007) suggested improving the quality and skills of Extension professionals as one strategy for transforming Cooperative Extension. Given the concerns about talented employees, it is recommended that Extension systems assess their human resource management practices using the competencies to inform efforts in hiring, professional development, and other key functions. At the same time, academic extension education programs should examine their curricular requirements and implement updates and revisions as needed.

4.3 Facilities; and

Table 4: Assessment of the Respondents in the EARIST Extension Services Program in Terms of Facilities

		EARIST EXTENSION SERVICES PROGRAM																							
		SDP			CEP																	ETP			
	Criteria	TM	FBS	SM	DP	TuM	TB	TP	FDWST	B2B	PS	JR	P&P	P	KATPS	PIA	VF	IDRRT	BPDPRT	MMM	MK	NHW	VPB	CCC	TOTAL
1	There is convenient and accessible facilities used in execution of the Extension programs including space and set-up.	4.15	4.12	4.17	4.16	4.12	4.19	4.15	4.13	4.15	4.15	4.18	4.18	4.15	4.17	4.12	4.18	4.15	4.18	4.17	4.2	4.15	4.15	4.13	**4.15**
2	There is a conductive skills training venue while implementation skills-learning capability.	4.11	4.15	4.15	4.13	4.12	4.11	4.16	4.11	4.15	4.13	4.18	4.12	4.16	4.17	4.18	4.19	4.11	4.12	4.16	4.1	4.19	4.16	4.18	**4.15**
3	There is an appropriate material and supplies needed in the skill-learning capability.	4.12	4.18	4.17	4.12	4.16	4.15	4.11	4.12	4.17	4.14	4.11	4.17	4.15	4.12	4.12	4.16	4.16	4.19	4.11	4.2	4.14	4.16	4.15	**4.15**
	TOTAL	**4.13**	**4.15**	**4.16**	**4.14**	**4.13**	**4.15**	**4.14**	**4.12**	**4.16**	**4.14**	**4.16**	**4.16**	**4.15**	**4.15**	**4.14**	**4.18**	**4.14**	**4.16**	**4.15**	**4.16**	**4.16**	**4.16**	**4.15**	**4.15**

Legend:

SDP - Skills Development Program
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MK - Math-alas na Kabataan

There is a better performance with respect to the EARIST Training Services Program through Skills Development, Community Education and Entrepreneurship training obtaining 4.19 as its weighted mean.

4.4 Advisory or Training Services?

Table 5: Assessment of the Respondents in the EARIST Extension Services Program in Terms of Advisoty of Training Services

		EARIST EXTENSION SERVICES PROGRAM																						
		SDP			CEP																	ETP			
	Criteria	TM	FBS	SM	DP	TuM	TB	TP	FDWST	B2B	PS	JR	P&P	P	KATPS	PIA	VF	IDRRT	BPDPRT	MMM	MK	NHW	VPB	CCC	TOTAL
1	The advisory or training services are executed on time bounded category as prescribed on the MOA.	4.32	4.34	4.31	4.36	4.31	4.31	4.33	4.33	4.35	4.32	4.32	4.32	4.34	4.32	4.34	4.32	4.33	4.31	4.32	4.31	4.31	4.33	4.31	**4.32**
2	The advisory or training services are clear and specific with continuos path nd direction.	4.34	4.33	4.32	4.35	4.34	4.33	4.32	4.32	4.33	4.34	4.31	4.33	4.31	4.31	4.33	4.31	4.32	4.31	4.31	4.33	4.32	4.31	4.34	**4.32**
3	The advisory or training services exhibit motivation to perform well in technical and vocational skills development.	4.32	4.31	4.33	4.33	4.31	4.31	4.31	4.33	4.31	4.33	4.33	4.31	4.36	4.35	4.31	4.34	4.33	4.31	4.28	4.34	4.33	4.33	4.31	**4.32**
4	The advisory or training services generate quality adopted by the clienteles.	4.21	4.25	4.22	4.19	4.22	4.23	4.21	4.19	4.2	4.21	4.19	4.23	4.24	4.22	4.23	4.23	4.26	4.22	4.24	4.22	4.15	4.16	4.23	**4.22**
	TOTAL	**4.3**	**4.31**	**4.3**	**4.31**	**4.3**	**4.3**	**4.29**	**4.29**	**4.3**	**4.3**	**4.29**	**4.3**	**4.31**	**4.3**	**4.3**	**4.3**	**4.31**	**4.29**	**4.29**	**4.3**	**4.28**	**4.28**	**4.3**	**4.3**

Legend:

SDP - Skills Development Program
CEP - Community Education Program
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The Table 5 denoted that there is 4.34 computed mean value with regards to the EARIST Training Services Program, which categorized into Skills Development, Community Education and Entrepreneurship Training.

The availability of technical assistance influences program implementation and critical components of successful program implementation (Durlak & DuPre, 2008). Technical assistance includes training of programs facilitators and program administrators, program evaluation and feedback, program monitoring, coaching, involvement of facilitators in program design, and the additional resources available to program stakeholders (e.g. brochures, manuals, online communities) (Wandersman et.al., 2008). Mihalic et.al. (2008) found that quality technical assistance prevented or identified potential programmatic issues that they have compromised implementation. Furthermore, when technical assistance is provided and used effectively, program quality increases (Wandersman et.al., 2008).

5. What is the most extent of financial dissemination criteria does the EARIST Extension Training Services Program were done?

Thru the accomplishment reports of the different colleges in extension program services, it generated that most of the extension activities were gathered and executed through contributions and donations of the professors and students. On the other hand, there is limited funding insist by the administration thru the effort of the office of extension services. There are some activities that are sustain with the help of benefactors and alumni support.

6. How EARIST Extension Training Services Program give benefit to the clienteles?

Thru the collaboration of the extended help between the students, professors and the administration together with the Extension Service Director, Dr. Eriberto R. Astorga Jr., the Extension Services extends help to the clienteles with (1) free extension training service consultation, (2) initiatives in operating skills development programs, entrepreneur training programs and community education programs, (3) financing extension activities and alike in order to transfer the different learning's from different colleges pertaining to Engineering, Industrial Technology, Arts and Sciences, Business Administration, Architecture and Fine Arts, Education, Hospitality Management and Public Administration and Criminology.

On the other hand, the EARIST has a big contribution in the inheritance of the growing and developing community even it is in the minimal stage of Extension Development. Apparently, the set activities and projects of the institution is either in the scope of the EARIST thrust or not will continuously quantify and qualify the continuous development of the society thru expert's offerings and greater transfer of learning capability in more viable and sustainable category.

7. How the evident EARIST Extension Training Services Program sustainable and viable?

Since, the Eulogio "Amang" Rodriguez Institute of Science and Technology (EARIST) is in the continuous goal of achieving quality services thru extension, it is observed that all levels of the different colleges are looking forward to enact skills development programs, entrepreneur training programs and community education. But, on the other hand, it is observed that there are minimal impartment of the transfer of learning which is sustainable to the society and community. As such, the viability of the different training programs and projects are not observed due to the lacking of budget and no greater extent of understanding of the implementation of the Extension Services pursuant to the CHED Memorandum Order No. 20 series of 2011 under section 10.

In this view, the researchers will enable to conceptualize the EARIST Extension Training Services Program, which are Sustainable and Viable through responsible allocation of the Source of Planning and Budgeting.

8. Using the result, What Source of Planning and Budgeting of Viable Extension Capability Plan may be proposed?

Table 6: The Sustainable and Viable Plan and Budget of EARIST Extension Capability Plan

Name of Colleges offering Extension Services	EARIST EXTENSION TRAINING SERVICES PROGRAM				
	Skills Development Programs	Entrepreneurship Training Program	Community Education	Allotted Budget	Remarks (Sustainable/ Viable)
College of Engineering (CEN)	1.Water Testing for Chemical Engineering 2.Design of Civil Engineer in Water Collection Task	3.Cooperative Education about: a.chemical/solution/ detergents b.computer repair c.engine formulation/design	4.Engineering Design under Electrical, Electronics and Communication 5.Mechanical Pumping 3.Solar Powering Pump	P 875, 000.00	Viable Viable Viable Sustainable Viable Viable
College of Industrial Technology (CIT)		1.Automotive 2.Drafting 3.Electronics Technology 4.Food Technology 5.Garments Trade 6.Machine Shop Technology 7.Refrigeration and Air-conditioning Technology		P 875, 000.00	All are Viable
College of Arts and Sciences (CAS)			1.Computer literacy	P 291, 666.66	Sustainable
College of Business Administration (CBA)	1.Marketing 2.Management 3.General Secretarial 4.Junior Secretarial 5Specialized Secretarial (legal, technical medical)			P 291, 666.66	All are Sustainable
College Architecture and Fine Arts (CAFA)		1.Art Exhibit 2.Painting Exhibit		P 291, 666.66	Viable

Name of Colleges offering Extension Services	EARIST EXTENSION TRAINING SERVICES PROGRAM				
	Skills Development Programs	**Entrepreneurship Training Program**	**Community Education**	**Allotted Budget**	**Remarks (Sustainable/ Viable)**
College of Hospitality Management (CHM)	1.Events Management III 2.House keeping 3.House Services 4.Front Office Management	1.Bartending 2.Cookery II 3.Tour Guiding 4.Travel Services 5.Food and Beverage II & III		P 291, 666.66	All are sustainable All Are viable
College of Education (CED)		1.Technology and Livelihood Education Form	1.Technology and Livelihood Education Form	P 291, 666.66	Sustainable Viable
College of Public Administration and Criminology (CPAC)			1.Leadership Training 2.Legal Information to Public	P 291, 666.66	Sustainable

CONCLUSIONS

From the findings of this study, the following conclusions were drawn:

1. The College of Engineering and College of Industrial Technology are the EARIST Thrust that is funded.

2. The EARIST Extension Training Services Plan and Budget Allocated thru CHED Memorandum No. 20 series of 2011under section 10 which is created and formulated by the College President thru the Director of Extension Services together with the staffs that enable to approved by the Board of Trustee (BOT) that composed of MOOE and Capital outlay which is appropriated P8,480,000.00 but institutionally allotted to P5,280,000.00.

3. The EARIST Extension Training Services Program relying to Skills Development Program, Entrepreneurship Training Program and Community Education are Tutorial on Mathematics, team building (Enhancing Skills in Alternative Mathematics), tutorial pictograph, familiarization of different words and story teller, box to basic, phonic sounds, jigsaw reading, pagbasa at pagsulat, pagguhit, kagandahang Asal at Tamang Pagbigkas ng Salita, pagkukwento ng ibat-inang akda, institute disaster risk reduction training, Math-tuto at maging Math-tinik, Math-alas na Kabataan, Disaster Preparedness, Brgy.Pinagkaisahan Disaster Preparedness and Response Training, Community Credit Cooperative, Values Formation, .Nutrition and Health Wellness, Veggie and Patty Burger, .Food and Beverages Skills, Sandwich making and taho making.

4. The EARIST Extension Programs in terms of Program Design, Resource Experts, Facilities and Advisory/Training Services are evaluates as better by the group of respondents with a mean value of 4.29, 4.40, 4.19 and 4.34 respectively

5. The most extent of financial dissemination criteria does the EARIST Extension Training Services Program were done is thru contributions and donations of the students and professors.

6. The EARIST Extension Training Services Program give benefit to the clienteles thru extending help with the essence of (1) free extension training service consultation, (2) initiatives in operating skills development programs, entrepreneur training programs and community education programs, (3) financing extension activities and alike in order to transfer the different learnings from different colleges pertaining to Engineering, Industrial Technology, Arts and Sciences, Business Administration, Architecture and Fine Arts, Education, Hospitality Management and Public Administration and Criminology.

7. There is no evident EARIST Extension Training Services Program that are sustainable and viable.

RECOMMENDATIONS

In the light of this study, the following are suggested for further enhancement and development of the study and other related researches:

1. The EARIST Administration together with the Director for Extension Services should give priority the planning and budgeting of the Extension Services thru course programs allocated by the EARIST Thrust.

2. Allocate systematic formulation of the EARIST Plan and Budget thru CHED Memorandum No. 20 series of 2011under section 10 together with the College President and Director of Extension Services and the staffs with the approval of the Board of Trustee (BOT).

3. The formulation of the EARIST Extension Training Services Program should empower through Skills Development Program, Entrepreneurship Training Program and Community Education that are important to the institute in catering community engagement in developing partnership to the society in achieving educational success.

4. Endure to produce a quality Extension Training Services Program in line with the Skills development, community education and entrepreneurship training.

5. Use the allocated and approved fund of the institute appropriately disseminating worthwhile activity or programs for Extension Training Services

6. Allocate other sources of funding in formulating and executing the Extension Programs through donor, benefactors and alumni support.

7. Continue to extend the formulation of the EARIST Extension Training Services Program.

8. Empower EARIST Extension Training Services Program that are sustainable and viable.

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CUSTOMER COMPLAINTS IN FOOD AND SERVICES IN SELECTED ETHNIC RESTAURANTS IN TRINOMA MALL, QUEZON CITY

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INTRODUCTION

Customers are the main reason of an establishment's growth. They are the people who patronize the products and the service of establishment. Customers have different preferences on choosing and buying a certain product, it usually depends on their needs and wants. There are customers that choose and patronize a certain product because that product provides their needs, other customers choose a product that commonly provide just their wants. Customer's feedback is the most important thing that an establishment must focus on, without them understanding their customer's complaints and appraisals, they are not going to be able to develop nor continue their excellent services. The management needs to have a good relationship to their customer, for them to achieve and get the customer's loyalty. There are few establishments that consider their customers only as their source of income which is wrong, they must feel and understand their customer because it will be the key for them to develop their existing products, improve their services and innovate new product that will provide to their current customer's needs. Customers themselves observe the place where they eat because they are concerned about the hygiene and in the quality of food they are eating. Their observations are included in their feedback its either it's a positive or negative feedback. Base on their feedbacks, the establishment will learn something that will help them to improve their products and services.

Complaints must be handled correctly by the establishment it must be used as a tool for improving the food and services. The establishment must hear the complaints attentively and at the same time there must be an expeditious solution for the certain complaints. Let the customer tell the whole story and make sure that sympathy is on their side, family restaurants should not treat their customer's complaints as a nuisance because the customer will feel bad and create unnecessary feedback to the restaurant. Handling complaints also includes of avoiding to be defensive, because it might result to another problem and bad customer relationship. Two of the most popular ethnic restaurants are Wee Nam Kee and Fish& Co. restaurant, these two ethnic type restaurants are the commonly chosen by the customers to dine in. This two ethnic type restaurant are well known for their commonly prepared cuisines which is Chinese and Singaporean cuisine. Since this two ethnic type restaurant is well known, they may encounter complaints during service to their customers.

STATEMENT OF THE PROBLEMS

The study focused on the Customer Complaints in Food and Services in Selected Ethnic Restaurants in Trinoma Mall, Quezon City.

Specifically, it sought to answer the following sub-questions:

1. How do the customers assess the Customer Complaints in Food and Services in Selected Ethnic Restaurants in Trinoma Mall, Quezon City?

2. Is there a significant difference on the assessment of the customers on Customer Complaints in Food and Services in the Selected Ethnic Restaurants when grouped according to customers and employees?

3. What intervention measures may be undertaken to lessen customer complaints?

SIGNIFICANCE OF THE STUDY

Upon the awareness of the study on a customer complaints in food and services, will benefit to the following:

Customers. This study will benefit the customers themselves in a way that they will know if their complaints are heard, they can use this as a guide and reference when they are going to experience or they already experienced the same complaints.

Employees. The employees themselves will benefit to this study, in a way that they are going to be able to make their services to the customers reach their very best so that they can receive an appraisal.

Faculty. This study will also benefit the faculty members, for them as mentors will be able to make their students aware on the latest trends in the industry.

Students. This study will benefit them, in a way that if they are going to choose a certain topic for their research that is related or may be just the same as this one, they are going to have an idea so that they can work on their thesis using a guide or preference.

Managers. The managers will benefit in this study, in a way that they can use this as a guide in improving their management strategy to the whole establishment.

Restaurant Owners. This research will help the restaurant owners for them to analyze and pay more attention to customers' complaints, so that the restaurant owners will be able to improve and avoid mistakes that will lead to another complaint.

LITERATURE AND STUDIES

Anlacan (2014) pointed out that there are few effective things in handling customer complaints one of those things is remain calm and objective, when facing an impossible customer the business personnel must not be carried by strong temper or any other emotion that can lead to rash decisions. Understand the customer, discover and analyze the problem so that the personnel will be able to think of further actions that will benefit the customer for the customer to feel that they are being heard keep the pointers of the situation and repeat it to them for clarifications. Always take the blame and say sorry to the customers they should not feel neglected by the business because their impression is a very important tool for the business and lastly, upon taking actions regarding the problem and take the problem encountered as a lesson and should not be repeated.

Go (2010) pointed out in his book that customers who are dissatisfied and delivered a complaints to an establishment can spread out his/her experience to other people through word of mouth. There are customers that change the product that they patronize depending on the brand, price and also their rate of satisfaction when consuming the certain product. Companies, need to make sure the satisfaction of their customers when consuming their

products, it is a company's ultimate goal. Customers that complain must be heard because if not, the customers will probably go to the establishment's competitors.

Bermundo, (2012) explained that All customer complaints are linked to disrespect maybe they've been kept waiting, or were passed on from one customer service rep to another, or maybe their call was never returned. Whatever the cause, when our customers are unhappy, it can be usually traced back to an element of disrespect, like rudeness, avoidance, attitude, failure to deliver on quality promises, etc.

Sanciano (2011) proved on his book that losing a customer because of a bad experience during the product selling and services will lead to decrease of company's profit. He also emphasized that the company's image is sorely affected by poor customer service or when unsavory customer experience takes place at any movement in time, that is, whether it is an isolated incident or not, unique to the occasion, or as it may be repeatedly occurring. In his book there is also a list of typical issues with a food service or hospitality company these are: bad food, poor housekeeping, long service periods-food preparation, vermin presence and language barrier or language deficiency that commonly make the customer to complain.

Alberto (2014) conducted a thesis on the usual complaints on food and food service received by different restaurants are slow in service and proper portion of foods. Since the customers chose to dine in a casual dining and fine dining restaurants, they are expecting a high level of service and food proportioning, but there are times that the customers are disappointed especially when the customers purchased the food in a high price. When comes to service, the customers are complaining not only because they are starving but also, the food's right temperature is lost this complaint usually results for the guest to be dissatisfied. The possible solutions recommended by the researchers are the establishment must develop their food's preparation plan so that they will be able to meet the guest's time expectation of the food to be served. They can also have an orientation for their personnel, so that each and every one will be aware of the customer's level of satisfaction.

Batac (2014) assessed that improper treatment of employees to the customers is the commonly complaint that a quick service restaurant receives, customers experienced it in the counter area and even in the dining area, as a solution for this the selected quick service restaurants must conduct an orientation program which will focus on the proper treatment of the customers, before and after their jobs starts. In this way, the complaints in improper treatment of guests will reduce or much better eliminated.

Gonzaga (2012) validated that for a better handling of customer complaints, a quick service restaurant must conduct an orientation program which will focus on the proper treatment of customers before they will be employed to their work assignments. A resource speaker who's an expert in interpersonal relationship and human behavior must be invited and consulted to give a lecture to the crew and front liners of the quick service restaurants.

METHODOLOGY

In this study, the researchers used the descriptive method of research with the survey questionnaire and analysis interpretation of data assessment of the Customer Complaint in Food and Services in Selected Family Restaurant in Fisher Mall, Quezon City. To obtain information concerning the current status of the phenomena to describe "what exist" with respect to the variables or conditions in a situation. The method involved range from the survey to describe the status and to developmental studies which seek to determine changes over time. This method is highly emphasized that can only be describe as a set of observation on the data collected.

RESULTS AND DISCUSSION

Sub-problem No. 1: How do the respondents assessed the Customer Complaints in Food and Service in Selected Ethnic Restaurants in Trinoma Mall, Quezon City?

Table 1

Assessment of Customer Complaints in Service in Selected Ethnic Restaurants in Trinoma Mall

Criteria	Employee		Customer		Composite	
	WM	VI	WM	VI	WM	VI
1. Slow in service	3.34	MA	3.96	A	3.65	A
2. Servers do not serve water until asked	2.36	LA	3.08	MA	2.72	MA
3. Inaccurate amount in the bill	2.76	MA	3.46	A	3.11	MA
4. Dishing out of plates while others are still eating	2.96	MA	3.60	A	3.28	MA
5.Unhygienic staff (long nails, unclip hairs)	3.18	MA	3.76	A	3.47	A
Overall weighted Mean	**2.90**	**MA**	**3.57**	**A**	**3.23**	**MA**

As assessed by employees the customer complaint in Food and Service in Selected Ethnic Restaurants was rated agree with an overall weighted mean of 2.90. All items rated as moderately agree, namely: Slow in service has weighted mean of 3.34, Unhygienic staff (long nails, unclip hairs)has a weighted mean of 3.18, Dishing out of plates while others are still eating has a weighted mean of 2.96, Inaccurate amount in the bill has a weighted mean of 2.76. Servers do not serve water until asked has a weighted mean of 2.36 was rated least agree.

On the other hand, the customers' assessment on the complaint in Food and Service in Selected Ethnic Restaurants was rated agree with an overall weighted mean of 3.57. All items rated as agree, namely: Slow in service has a weighted mean of 3.96, Unhygienic staff (long nails, unclip hairs) has a weighted mean of 3.76, Dishing out of plates while others are still eating has a weighted mean of 3.60, and Inaccurate amount in the bill has a weighted mean of 3.46. Servers do not serve water until asked has a weighted mean of 3.08, was rated moderately agree.

Generally, the assessments of the customers' complaint in Service in Selected Ethnic Restaurants was rated as moderately agree with composite weighted mean of 3.23. The areas of concern rated agree, such as: Slow in service has a weighted mean of 3.65, and Unhygienic staff (long nails, unclip hairs) has a weighted mean of 3.47. Dishing out of plates while others are still eating has a weighted mean of 3.28, Inaccurate amount in the bill has a weighted mean of 3.11 and Servers do not serve water until asked has a weighted mean of 2.72 was rated as moderately agree.

Table 2

Assessment of Customer Complaints in Food in Selected Ethnic Restaurants in Trinoma Mall

Criteria	Employee		Customer		Composite	
	WM	VI	WM	VI	WM	VI
1.Meals to be served hot are serve cold	3.06	MA	3.76	A	3.41	A
2. Beverages to be serve cold are serve warms	3.12	MA	3.42	A	3.27	MA
3.Sanitized utensils facilities etc.	2.44	LA	3.48	A	2.96	MA
4.Incorrect serving of orders	2.82	MA	3.66	A	3.24	MA
Overall weighted Mean	**2.86**	**MA**	**3.58**	**A**	**3.22**	**MA**

As assessed by employees the customer complaint in Food and Service in Selected Ethnic Restaurants was rated moderately agree with an overall weighted mean of 2.86. All items rated as moderately agree, namely: Meals to be served hot are serve cold has a weighted mean of 3.06, Beverages to be serve cold are serve warms has a weighted mean of 3.12, Incorrect serving of orders has a weighted mean of 2.82. Sanitized utensils facilities etc. has a weighted mean of 2.44 was rated least agree.

On the other hand, the customers' assessment on the complaint in Food and Service in Selected Ethnic Restaurants was rated agree with an overall weighted mean of 3.58. All items rated as agree, namely: Meals to be served hot are serve cold has a weighted mean of 3.76, Incorrect serving of orders has a weighted mean of 3.66, Sanitized utensils facilities etc. has a weighted mean of 3.48, and Beverages to be serve cold are serve warms has a weighted mean of 3.42.

Generally, the assessments of the customers' complaint in Food Selected Ethnic Restaurants was rated as moderately agree with an overall weighted mean of 3.22. The area of concern rated agree such as: Meals to be served hot are serve cold has a weighted mean of 3.41. Beverages to be serve cold are serve warms has a weighted mean of 3.27, Incorrect serving of orders has a weighted mean of 3.24 and Sanitized utensils facilities etc. has a weighted mean of 2.96 was rated as moderately agree.

Table 3

Summary of the assessment of Customer Complaints in Food and Service in Selected Ethnic Restaurants in Trinoma Mall

Criteria	Employee		Customer		Composite	
	WM	VI	WM	VI	WM	VI
1. Slow in service	3.34	MA	3.96	A	3.65	A
2. Dirty or ill equipped	2.36	LA	3.08	MA	2.72	MA
3. Impolite staff	2.76	MA	3.46	A	3.11	MA
4. Meals or beverage served at the incorrect temperature	2.96	MA	3.60	A	3.28	MA
5. Improper Sanitation (Utensils, facilities, etc.)	3.18	MA	3.76	A	3.47	A
6. Meals that is served are not the orders of customers (changing of customers' order from other)	3.06	MA	3.76	A	3.41	A
7. Serves not bringing water until asked.	3.12	MA	3.42	A	3.27	MA
8. Inaccurate calculation of check by server	2.44	LA	3.48	A	2.96	MA
9. Server removing the plate or beverage even if one of the guests are not yet finish	2.82	MA	3.66	A	3.24	MA
Overall Weighted Mean	**2.90**	**MA**	**3.58**	**A**	**3.24**	**MA**

As assessed by employees the customer complaint in Food and Service in Selected Ethnic Restaurants was rated moderately agree with an overall weighted mean of 2.90. All items rated as moderately agree, namely: Slow in service has a weighted mean of 3.34, Unhygienic staff (long nails, unclip hairs) has a weighted mean of 3.18, Beverages to be served cold are serve warms has a weighted mean of 3.12, Meals to be served hot are serve cold has a weighted mean of 3.06, Dishing out of plates while others are still eating has a weighted mean of 2.96, Incorrect serving of orders has a weighted mean of 2.82 and Inaccurate amount in the bill has a weighted mean of 2.76. Sanitized utensils facilities etc. has a weighted mean of 2.44 and Servers do not serve water until asked has a weighted mean of 2.36 was rated least agree.

On the other hand, the customers' assessment on the complaint in Food and Service in Selected Ethnic Restaurants was rated agree with an overall weighted mean of 4.52. All items rated as agree, namely: Slow in service has a weighted mean of 3.96, Unhygienic staff (long nails, unclip hairs) and Meals to be served hot are serve cold has a weighted mean of 3.76, Incorrect serving of orders has a weighted mean of 3.66, Dishing out of plates while others are still eating has a weighted mean of 3.60, Sanitized utensils facilities etc. has a weighted mean of 3.48, Inaccurate amount in the bill has a weighted mean of 3.46 and Beverages to be served cold are serve warms has a weighted mean of 3.42. Servers do not serve water until asked has a weighted mean of was rated moderately agree.

Generally, the assessments of the customers' complaint in Food and Service in Selected Ethnic Restaurants was rated as agree with composite weighted mean of 3.24. The areas of concern rated agree, such as: Slow in service has weighted mean of 3.65, Unhygienic staff (long nails, unclip hairs) has weighted mean of 3.47 and Meals to be served hot are serve cold has weighted mean of 3.41. The areas of concerns rated moderately agree, namely: Dishing out of plates while others are still eating has weighted mean of 3.28, Beverages to be served cold are serve warms has weighted mean of 3.27, Incorrect serving of orders has weighted mean of 3.24 and Inaccurate amount in the bill has weighted mean of 3.11, Sanitized utensils facilities etc. has weighted mean of 2.96 and Slow in service has weighted mean of 2.72.

Sub-problem No. 2: Is there a significant difference on the assessment of the Customers Complaints in Food and Services in the Selected Ethnic Restaurants when grouped according to customers and employees?

Table 4

Significant Difference on the Customers Complaints in Food and Services in the Selected Ethnic Restaurants

t-value	Critical Value	Decision	Interpretation
4.023	1.658	Reject Ho	Significant

df = 98 at 5% level of significance

As manifested in the table, the computed t-value on the assessment of employees and customers on the Customers Complaints in Food and Services in the Selected Ethnic Restaurants is 4.023 which is higher than critical value of 1.658 at 5% level of significance with the degree of freedom of 98, therefore, there is significant difference on the assessment on the Customers Complaints in Food and Services in the Selected Ethnic Restaurants.

Sub-problem No. 3: What are the intervention measures may be undertaken to lessen customer complaints?

Table 5

Intervention Measures

Areas of Concern	Employees		Customer		Composite	
	WM	VI	WM	VI	WM	VI
1. Before preparing the utensils be sure that it is cleaned and sterilized	4.24	HA	4.34	HA	4.29	HA
2. Re-read the orders in front of the customers	4.42	HA	4.02	A	4.22	HA
3. Check the foods to be served against the order	4.26	HA	4.02	A	4.14	A
4. Secure to check the temperature of Food and Beverages before serving (Hot and Cold)	4.02	A	4.02	A	4.02	A
5. Double check the bills before presenting to the customers	4.02	A	4.12	A	4.07	A
Overall Weighted Mean	**4.19**	**A**	**4.10**	**A**	**4.15**	**A**

As assessed by employees, the intervention measures may be undertaken to lessen customer complaints was rated acceptable with an overall weighted mean of 4.19. Items rated as highly acceptable, namely: Re-read the orders in front of the customers has a weighted mean of 4.42, Check the foods to be served against the order has a weighted mean of 4.26, Before preparing the utensils be sure that it is cleaned and sterilized has a weighted mean of 4.24. Secure to check the temperature of Food and Beverages before serving (Hot and Cold) and Double check the bills before presenting to the customers has a weighted mean of 4.02 rated as acceptable.

On the other hand, customers' assessment on the intervention measures may be undertaken to lessen customer complaints was rated acceptable with an overall weighted mean of 4.10. Before preparing the utensils be sure that it is cleaned and sterilized has a weighted mean of 4.34 rated as highly acceptable. Items rated as acceptable, namely: Double check the bills before presenting to the customers has a weighted mean of 4.12, Re-read the orders in front of the customers, Check the foods to be served against the order and Secure to check the temperature of Food and Beverages before serving (Hot and Cold) has a weighted mean of 4.02.

Generally, the overall assessment on the intervention measures may be undertaken to lessen customer complaints was rated accepted with an overall weighted mean of 4.15. Before preparing the utensils be sure that it is cleaned and sterilized has a weighted mean of 4.29 and Re-read the orders in front of the customers has a weighted mean of 4.22 rated as highly accepted. All items rated as accepted, namely: Check the foods to be served against the order has a weighted mean of 4.14, Double check the bills before presenting to the customers has a weighted mean of 4.07 and Secure to check the temperature of Food and Beverages before serving (Hot and Cold) has a weighted mean of 4.02.

CONCLUSIONS, AND RECOMMENDATIONS

From the findings of the study, the following are concluded:

1. The assessments of the Customer Complaints in Food and Services in Selected Ethnic Restaurants is rated as moderately agree by the customers and employees.

2. There is significant difference on the assessment of the Customer Complaints in Food and Services in Selected Ethnic Restaurants.

3. All of the criteria on the intervention measures may be undertaken to lessen Customer Complaints is rated accepted by customers and employees.

From the findings and conclusions of the study, the following are recommended.

1. The establishments should check the foods to be served against the order of the customers.

2. Both of the restaurants should secure to check the temperature of Food and Beverages before serving (Hot and Cold)for them to get an excellent impression from the customers.

3. The restaurants also must double check first their customers' bills before presenting it to the customers for them to avoid dismaying the customers.

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QUALITATIVE RESEARCH MODULE FOR SECOND YEAR COLLEGE STUDENTS: BASIS FOR ENHANCED ACADEMIC PERFORMANCE

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INTRODUCTION

Educational research is one of the greatest concerns of the institutions related to education. A school that loses its desire to do research activities and fail to participate or contribute to the welfare of educational research cannot be called a school institution. From the principal down to students, every school must attend to the needs of research. Education is not there merely to conduct the "process of facilitating learning. "In addition, education has to do more in-depth study on many topics such as teaching, training, and directed research. For our education to be meaningful to teachers and students, we have to show our serious commitment to enhance educational research.

Nevertheless, the teaching and learning of research is a difficult task for both the teachers and the students. Research in education requires personnel expertise, competence, technical skill and patience. We cannot operate or start a research without these human attributes. Because doing research is more on human activity. However, little by little, tools are being developed to help researchers to be more efficient. This is the reason why this module has been developed and being tried out for its effectiveness. Meanwhile, educational research can be sourced in three components: qualitative research, quantitative research and mixed approach. Qualitative research on education or QRE is the focus of this paper. As QRE attracts many researchers as it simply attempts to find an "objective, unbiased solution to the problem to validate the procedures employed."

(Anderson & Arsenault, 1998). A deliberate activity is directional but often refines the problem or questions as the research progresses. Mark R. Warren of Harvard University explains that qualitative research, in contrast to quantitative research, "generally does not translate aspects of the world into numbers to be analyzed mathematically. Instead, it analyzes the world through the lenses the researcher brings to bear on the data" (Seidman, 2013).

STATEMENT OF THE PROBLEMS

The main purpose of this study is to test through experiment the effectiveness of a developed module research for second year college students.

Specifically, the study tried to answer the following questions:

1. What are the results of the pre-test in research of the experimental group and the control group?

2. What is the significant difference on the Pre-test means of the experimental group and the control group?

3. What are the results of the post-test in research of the experimental group and the control group?

4. What is the significant difference of the posttest means between the experimental group and the control group?

5. What is the significant difference between the pre-test and the posttest means of the experimental group and the control group?

6. What other modular activities maybe included to further improve the academic performance in research of Second Year College students of EARIST?

SIGNIFICANCE OF THE STUDY

The study will be significant and will benefit the following:

Students. The results of the study will provide insights in determining the most appropriate teaching methodology in Research to ensure that the learners will acquire the desired competencies.

Faculty. The study will guide the teachers in determining the appropriate instructional methodology in Research and ensure that behavioral change in terms of learning will be attained.

School Administrators. The findings and recommendations of the study will serve as a guide among the school administrators in assessing and determining the appropriate teaching methodology in research.

Curriculum developers. The findings and recommendations of the study will serve as guide to curriculum developers in designing or recommending the most appropriate teaching methodology according to learning area to ensure that learners will be equipped with the needed skills and competencies.

Other Researchers. The results of the study may provide other researchers the idea of constructing instructional module in their own study.

LITERATURE AND STUDIES

In 2010 the new basic education program has been introduced with the K to 12 Curriculum offered to Senior High School, equivalent to first year college. An applied course covers research study that develops the students' critical thinking and problem solving skills through qualitative research. With all the changes in education, it is more necessary for teachers to utilize appropriate instructional methods. In 2009, Salandanan suggests a particular method that is strategic and innovative and that the teacher should introduce carefully and reflectively, the use of module.

The Philippine educational system also emphasized implementing the modular approach in the curriculum believing that this strategy may help the students to improve their knowledge in classroom activities. The purpose of the module is to support the teachers in achieving the objectives of the lessons and to provide the students with the opportunity to learn easily the subject matter.

Module as a self-contained and independent unit has its substance consisting of materials and instructions needed to accomplish such objectives. The use of module serves as enrichment or supplementary instructional materials for learning concepts and skills, as

remedial instruction is necessary for slow learners and as advance instruction for the fast and highly motivated ones (Balderas, 2013). Hidalgo (2005) encourages teachers should continuously provide remedial activities, and that teachers should be provided with better instructional materials, study guides and workshops to supplement textbooks. It helps lot of teachers to have these materials on hand in promoting cooperative learning activities among their students and one of these materials is the qualitative module.

Zulueta (2006), self-pacing, with the subject matter that is short enough and well defined enumerates a module that should be self-contained. It is also adequately motivating and provides opportunities for interaction with the learner.
Its objectives and activities should properly sequenced, clearly written to make it interesting and appealing to the learning, no wrong implication to other subject matter or values and should utilize every opportunity to achieve affective learning. Module contains necessary components, which is supportive of each other.

Santos (2011) describes instructional modules that can be developed following the modular approach to learning. Learning tasks are clearly stated here so that students can be guided along concept of self-learning. Instructional module is designed to serve individual progress. It comes in handy to serve individual need of the learner and will foster higher learning skills, discovery, participatory learning and developed competencies needed by the students not only to pass examinations but also to confront the reality of life through experiences and challenges.

Flores, 2007 who conducted a study on the Proposed Instructional Modules in Physics revealed that instructional materials were not sufficient so there is a need to produce self-instructional module.

Macarandang (2009) emphasized the evaluation of a proposed set of modules in Principles and Methods of Teaching. It concludes that the contents of module reflect the most important aspects of what is being taught to students because it includes lessons and topics that meet the requirements of authorities on Teacher Education.

The study conducted by Ali (2005) examines the effectiveness of modular teaching in Biology because it reveals that module is more effective in the teaching-learning process. Students in modular approach got high score compared to those in the traditional teaching method.

METHODOLOGY

This chapter contains the research methods used such as the method of collecting data and information; what and how research instruments is to be performed, and the process by which statistical treatment of data is to be organized. It includes a consideration of the concepts and theories that underlie the methods. It shows that the paper understands the underlying concepts of the methodology. It explains and justifies with clear reasons for the choice of the particular methods.

RESULTS AND DISCUSSIONS

Problem No. 1: What are the pre-test results on the qualitative research test of the experimental group (modular) and the control group (non-modular)?

Table 1

Pre-test Results on the Qualitative Research Test of the Experimental Group and the Control Group

	N	Pre-test Mean	Descriptive Level	Standard Deviation
Experimental Group (Modular)	50	58.48	Needs Improvement	1.49 Heterogeneous
Control Group (Non-modular)	50	56.92	Needs Improvement	1.98 Heterogeneous
Total	**100**			

Table 1 presents the results of the pre-test on the qualitative research test of the experimental group and the control group. **Table 1** shows that initially the experimental group obtains a pre-test mean of 58.48 out of the 100-item test on qualitative research with a standard deviation of 1.49. The control group obtains a mean of 56.92 with a standard deviation of 1.98.

This shows that at the start, the two groups are both at the same level of needing improvement. They are both heterogeneous.

Problem No. 2: What significant difference exists on the pre-test results between the experimental group and the control group?

Table 2

T-Test Result of Significant Difference between the Pre-test Means of Experimental and Control Groups

	N	Pre-test Mean	Df	Critical Value	T. Test	Significant Difference
Experimental Group (Modular)	50	58.48		.05 = 1.980	1.49	No significant difference
			98		is less than	
Control Group (Non-modular)	50	56.92		.01 = 2.617	1.980	
Mean Difference		**1.56**				

Table 2 presents the result of the t-test of significant difference between the pre-test of the experimental group (modular) and the pre-test of the control group (non-modular). As reflected in the table, there is a mean difference of 1.56 between the pretest results of the experimental group and the control group. However, this mean difference is not significant based on the T-test value of 1.49 which is lower than the critical value of 1.980 at.05 level of significance.

This shows that there is no significant difference between the entry behaviors of the two groups. They are equated on their entry knowledge about research. This means that the experiment could be initiated since the two groups had the same amount of learning at the start. The groups had been equated to ensure that the intervention of using the module is the one that will give impact on learning.

Problem No. 3: What are the results of the posttest in research of the experimental group (modular) and the control group (non-modular)?

Table 3

Posttest Results on the Qualitative Research Test of the Experimental Group and the Control Group

	N	Post Test Mean	Descriptive Level	Standard Deviation
Experimental Group (Modular)	50	84.48	Satisfactory	2.05 Heterogeneous
Control Group (Non-Modular)	50	78.36	Fair	2.12 Heterogeneous
Mean Difference		**6.12**		

The experimental group obtains a mean of 84.48 as satisfying level and standard deviation of 2.05. On the other hand, the control group obtains a mean of 78.36 or fair level.

Flores (cited in 2007) conducted a study on “The Proposed Self-Instructional Modules in Physics” revealed in his findings that the available instructional materials were not sufficient and not suited to the demands of the majority of the students and so there was a need to produce self-instructional materials.

According to Santos (2011), instructional modules can be developed following the modular approach to learning. In modules, learning tasks are clearly stated, and so organized and sequenced so as to guide students along concept of self-learning. Instructional modules are designed to serve individual progress, viewed as most effective compared with group and individualized learning. The print modules are flexible in terms of scheduling, individual study, mastery concept, and prescribed instruction. Instructional modules come in handy to serve individual need of the learner while fostering higher thinking skills, discovery, constructive and participatory learning through modular approaches to developing competencies needed by the students not only to pass examinations, but to confront real-life experiences and challenges.

Problem No. 4: What significant difference exists in the results of posttest between the experimental group (modular) and the control group (non-modular)?

Table 4

T-Test Results of Significant Difference between the Post Test of the Experimental Group (Modular) and the Control Group (Non-Modular)

	N	Post-test Mean	Df	Critical Value	T. Test	Significant Difference
Experimental Group (Modular)	50	84.48		.05 = 1.980	3.32	
			98		is more than	**Significant Difference**
Control Group (Non-modular)	50	78.36		.01 = 2.617	2.617	
Mean Difference		**6.12**				

Table 4 reflects the significant difference that exists in the mean results of posttest between the experimental group and the control group. The table above shows that there is a mean difference of **6.12** between the posttest results of the experimental group and the control group. The T-test result is **3.32** which is higher than the critical value of **2.617** at .01 level of significance. This means that there is a significant difference between the posttest means of the experimental and the control groups.

This also shows that experimental group significantly obtains a higher mean. It means that the use of module is more effective than the traditional method. This finds support in the study of Ali (2005) wherein the effectiveness of modular teaching was proven when the students got higher scores in Biology than those in the traditional teaching method.

Problem No. 5: What significant difference exists between the pretest results and the posttest results of the experimental group and the control group?

Table 5

T-Test Result between the Pre-Test and Post Test Of the Experimental Group (Modular)

	N	Mean		Df	Critical Value	T-Test
		Pre-Test	Post Test			
Experimental Group	50	58.48	84.48	49	.05 = 2.010 .01 = 2.682	29.38
Mean Difference		26				**Significant at .01 level of significance**

Table 5 shows that a significant difference exists between the pre-test results and the posttest results of the two groups. The table above reveals that for the experimental group the T-test result is 29.30 that is higher than critical value of 2.682 at .01 level of significance with 49 degrees of freedom. This shows that the mean difference of 26 indicates a significant difference between the pretest and posttest result of the experimental group. This also means that with the modular approach as a strategy on learning research, there is a gain in learning.

Problem No. 6: What other modular activities maybe included furthering improving the academic performance in research of Second Year College students of EARIST?

Table 6
T-Test Result between the Pre-Test and Post Test of Control Group (Non-Modular)

	N	Mean		Df	Critical Value	T-Test
		Pre-Test	Post Test			
Control Group	50	56.92	78.36	49	.05 = 2.010 .01 = 2.682	24.31
Mean Difference		21.44				**Significant at .01 level of significance**

The table above reveals the T-test result of 24.31 with a mean difference of 21.44 at .01 level of significance with 49 degrees of freedom. This shows that there is significant difference between the pre-test and posttest results of the control group. There is a gain in learning and conclusively the mean difference from pre-test to posttest in the experimental group is 26 while in the control it is 21.44.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of the study, the following conclusions are drawn:

1. Initially, the entry behavior of the experimental and the control groups proved to be both needing improvement. The students need to develop their understanding of research.

2. At the start of the experiment, the students' entry behavior and knowledge about research are equated, all desired variables are controlled.

3. After the experiment and intervention on the use of module, the posttest proved a higher learning improvement with the experimental group's use of module.

4. The use of module as intervention proved to be effective on the academic achievement of the students.

5. The pretest-posttest results proved gains in learning with greater impact on the experimental group due to the intervention.

Based on the findings and conclusions presented, the following are recommended and suggested:

1. In an experimental study, initially the experimental and the control groups should be equated in knowledge about research to make sure that the intervention of the qualitative research module would be the one that would give impact on learning.

2. The qualitative research module should be tailored based on the prescribed objectives and the needs of the students.

3. The faculty handling research subject may be enjoined to utilize the qualitative research module as instructional aide.

4. The school administrators may encourage the modular approach as one of the teaching strategies of the faculty members.

5. The students may also use the said qualitative module for self-study.

6. Further evaluation and feedback in using qualitative research modules may be elicited.

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PRIVACY IN THE AGE OF DIGITALSOCIAL MEDIA: AN ASSESMENT OF SMARTPHONES

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INTRODUCTION

A **smartphone** or **smart phone** is a mobile phone with an advanced mobile operating system which combines features of a personal computer operating system with other features useful for mobile or handheld use. They typically combine the features of a cell phone with those of other popular mobile devices, such as personal digital assistant (PDA), media player and GPS navigation unit.

Most smartphones can access the Internet, have a touchscreen user interface, can run third-party apps, music players and are camera phones. Most Smartphones produced from 2012 onwards also have high-speed mobile broadband 4G LTE internet, motion sensors, and mobile payment mechanisms.

In 2007, Apple Inc. introduced the iPhone, one of the first smartphones to use a multi-touch interface. The iPhone was notable for its use of a large touchscreen for direct finger input as its main means of interaction, instead of a stylus, keyboard, or keypad typical for smartphones at the time.

2008 saw the release of the first phone to use Android called the HTC Dream (also known as the T-Mobile G1). Android is an open-source platform founded by Andy Rubin and now owned by Google. Although Android's adoption was relatively slow at first, it started to gain widespread popularity in 2010, and now dominates the market.

These new platforms led to the decline of earlier ones. Microsoft, for instance, started a new OS from scratch, called Windows Phone. Nokia abandoned Symbian and partnered with MS to use Windows Phone on its smartphones.

Windows Phone then became the third-most-popular OS. Palm's web OS was bought by Hewlett-Packard and later sold to LG Electronics for use on LG smart TVs. BlackBerry Limited, formerly known as Research in Motion, also made a new platform from scratch, BlackBerry 10. The capacitive touchscreen also had a knock-on effect on smartphone form factors. Before 2007 it was common for devices to have a physical numeric keypad or physical QWERTY keyboard in either a candy bar or sliding form factor. However, by 2010, there were no top-selling smartphones with physical keypads.

SMARTPHONE USAGE

In the third quarter of 2012, one billion smartphones were in use worldwide. Global smartphone sales surpassed the sales figures for features phones in early 2013. As of 2013, 65

percent of U.S. mobile consumers own smartphones. The European mobile device market as of 2013 is 860 million.

In China, smartphones represented more than half of all handset shipments in the second quarter of 2012 and in 2014 there were 519.7 million smartphone users, with the number estimated to grow to 700 million by 2018.

As of November 2011, 27% of all photographs were taken with camera-equipped smartphones. A study conducted in September 2012 concluded that 4 out of 5 smartphone owners use the device to shop. Another study conducted in June 2013 concluded that 56% of American adults now owned a smartphone of some kind.

Android and iPhone owners account for half of the cell phone user population. Higher income adults and those under age 35 lead the way when it comes to smartphone ownership.

Worldwide shipments of smartphones topped 1 billion units in 2013 (up 38% from 2012's 725 million) while comprising a 55% share of the mobile phone market in 2013 (up from 42% in 2012).

TOP SMARTPHONES

1. SAMSUNG
2. APPLE
3. LG
4. ALCATEL
5. HUAWEI
6. LENOVO
7. HTC
8. XIAOMI
9. SONY
10. ZTE

PRIVACY

As technology has advanced, the way in which privacy is protected and violated has changed with it. In the case of some technologies, such as the printing press or the Internet, the increased ability to share information can lead to new ways in which privacy can be breached. It is generally agreed that the first publication advocating privacy in the United States was the article by Samuel Warren and Louis Brandeis, "The Right to Privacy", Vol. IV *Harvard Law Review* 193 (1890), that was written largely in response to the increase in newspapers and photographs made possible by printing technologies.

New technologies can also create new ways to gather private information. For example, in the United States it was thought that heat sensors intended to be used to find marijuana-growing operations would be acceptable.

However, in 2001 in Kyllo V. United States (533 U.S. 27) it was decided that the use of thermal imaging devices that can reveal previously unknown information without a warrant does indeed constitute a violation of privacy.

Generally the increased ability to gather and send information has had negative implications for retaining privacy. As large-scale information systems become more common, there is so much information stored in many databases worldwide that an individual has no practical means of knowing of or controlling all of the information about themselves that others may have hold or access. Such information could potentially be sold to others for profit and/or be used for purposes not known to or sanctioned by the individual concerned. The concept of information privacy has become more significant as more systems controlling more information appear.

Also the consequences of privacy violations can be more severe. Privacy law in many countries has had to adapt to changes in technology in order to address these issues and, to some extent, maintain privacy rights. But the existing global privacy rights framework has also been criticized as incoherent and inefficient. Proposals such as the APEC Privacy Framework have emerged which set out to provide the first comprehensive legal framework on the issue of global data privacy.

There are various theories about privacy and privacy control. The Invasion Paradigm defines privacy violation as the hostile actions of a wrongdoer who causes direct harm to an individual. This is a reactive view of privacy protection as it waits until there is a violation before acting to protect the violated individual, sometimes through criminal punishments for those who invaded the privacy of others. In the Invasion Paradigm this threat of criminal punishment that is supposed to work as deterrent.

The Secrecy paradigm defines a privacy invasion as someone's concealed information or hidden world being revealed through surveillance. The Negative Freedom Paradigm views privacy as freedom from invasion rather than a right, going against the more popular view of a "right to privacy."

Finally, the Inaccessibility Paradigm states that privacy is the state where something is completely inaccessible to others. Daniel Solove, a law professor at George Washington University also has a theory of privacy.

He believes that a conceptualized view of privacy will not work because there is no one core element. There are many different, interconnected elements involved in privacy and privacy protection.

Therefore, Solove proposes looking at these issues from the bottom up, focusing on privacy problems. People may often overlook the fact that certain elements of privacy problems are due to the structure of privacy itself. Therefore, the architecture must change wherein people must learn to view privacy as a social and legal structure. He also states that people have to redefine the relationship between privacy and businesses and the government. Participation in certain privacy elements of the government and businesses should allow people to choose whether they want to be a part of certain aspects of their work that could be considered privacy invasion.

THEORETICAL FRAMEWORK

This investigative study is anchored on the different theories discussed below:

Conspiracy Theory

A conspiracy theory is an explanatory hypothesis that accuses two or more persons, a group, or an organization of having caused or covered up, through secret planning and deliberate action, an event or situation which is typically taken to be illegal or harmful. Although the term "conspiracy theory" has acquired a derogatory meaning over time and is often used to dismiss or ridicule beliefs in conspiracies, it has also continued to be used to refer to actual, proven conspiracies, such as United States President Richard Nixon and his aides conspiring to cover up the Watergate scandal in the 1970s.

The Oxford English Dictionary defines conspiracy theory as "the theory that an event or phenomenon occurs as a result of a conspiracy between interested parties; spec. a belief that some covert but influential agency (typically political in motivation and oppressive in intent) is responsible for an unexplained event", and cites a 1909 article in The American Historical Review as the earliest usage example. Currently, conspiracy theories are widely present on the Web, in the forms of blogs and YouTube videos. For example, power relations in social groups and the perceived existence of evil forces.

1) Designation assigned by corporate media to any idea divergent of government script.

2) Results from careful and unbiased analysis of the facts and circumstances surrounding a high profile event, proving an agenda is/was in motion.

3) So called ‘conspiracy theorists’ preferred to be called ‘agenda analysts’ or simply thinkers.

Privacy Regulation Theory

Privacy regulation theory was developed by social psychologist Irwin Altman in 1975. This theory aims to explain why people sometimes prefer staying alone but at other times like get involved in social interactions. Traditionally, privacy is regarded as a state of social withdrawal (i.e., avoiding people).

Altman, however, regards it as a dialectic and dynamic boundary regulation process where privacy is not static but “a selective control of access to the self or to one’s group”. According to Altman, “dialectic” refers to the openness and closeness of self to others (i.e., seeking and avoiding social interaction); while “dynamics” indicates that the desired privacy level (i.e., the ideal level of contact at a particular time), which varies due to individual and cultural differences, continuously moves along the continuum of openness and closeness in response to different circumstances over time. In other words, the desired privacy level changes with time according to environment. Therefore, we might want to avoid people at a particular time but desire contact at another time.

Altman also believes the goal of privacy regulation is to achieve the optimum level of privacy (i.e., the ideal level of social interaction). However, if our actual level of privacy is greater than the desired one, we will feel lonely or isolated; on the other hand, if our actual level of privacy is smaller than the desired one, we will feel annoyed or crowded.

In order to regulate our privacy (i.e., social interaction) successfully, we need to use a variety of behavioral mechanisms such as verbal, Para verbal and non-verbal behavior, environmental mechanisms of territoriality and personal space, etc.

Theory of Choice and Defeat

Daniel Soper's theory of choice and defeat presents a stark in-your-face assessment of smartphone privacy. Basically his theory suggests that if you want the benefits of mobile computing- and that is your choice- you must be willing to relinquish some of your own private data. His defeatist attitude seems to be accepted by the greatest majority of smartphone users.

The main proponent of this theory contends that human movement which is characterized by location tracking within the smartphone environment and results in data collection by service providers is wholly predictable. Wireless service providers which collect this data along with apps can assemble and presents patterns of movement. Mobile tracking is just beginning to enter the consciousness of individual and the public as a whole as a potential privacy issue.

Another point of this theory extends to Soper's push for the idea of self- regulation (choice by the mobile industry) as opposed to government regulations controlling aspects of smartphones. In response to the data exploitation by app developers and ad networks with harmful intents, Soper is pushing the quick adoption of standards created by the industry to curtail dangerous practices.

Rather than the choice of defeat, I propose smartphone users demand the choice to know clearly and upfront an app's data intent along with the option to decline tracking and data collection. The foundation of this theory contributes to the overall theme of privacy loss and hidden dangers as presentable choice. Extension to include user demands to do- not- track or collect data can eliminate the hidden dangers associated with the smartphone use.

Conceptual Framework

The conceptual model which will be the guide in this study follows the System Approach Model utilizing the **Input, Process and Output** model which is shown in Figure 1.

The conceptual framework discussed the flow of the study to be taken. The system of the frames is composed of input which went through the process and the result is the output.

The input contains the variables on the profile of respondents, privacy applications on smartphones, importance of and characteristics of smartphones. The process contains the procedure to be used to analyze those variables. The output contains the effective result of the study.

The arrows include the workflow of information in the research process. The feedback connects the output to the process involved as well the input.

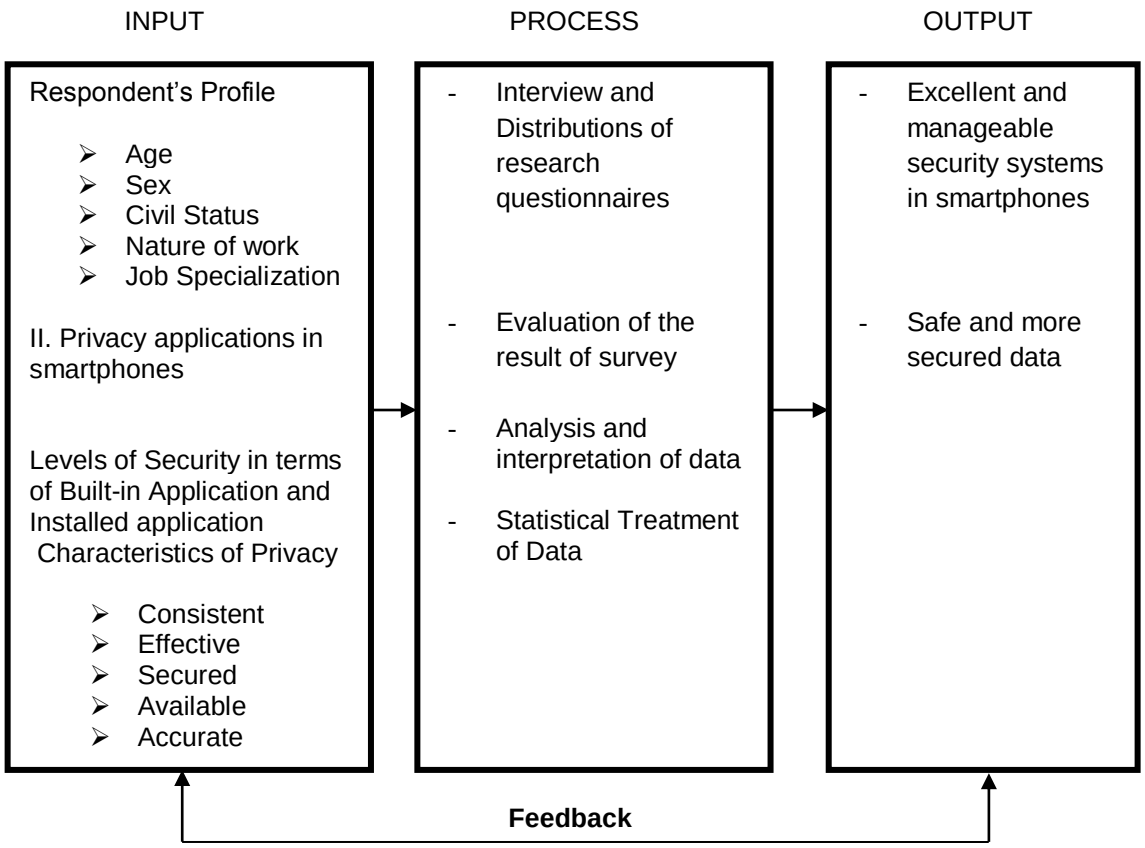

Figure 1. Research Paradigm

STATEMENT OF THE PROBLEM

This study aimed to evaluate the assurance of security of the consumer's privacy in using smartphones in the digital social media age among the employees of various sectors.

This research sought to answer the following questions:

1. What is the profile of the respondent in terms of the following?
   - Age
   - Gender
   - Civil Status
   - Nature of work
2. What is the level of security do smartphones provide as perceived by the respondents when categorized in terms of the following?

2.1 Built in Applications

2.2 Installed Applications

3. Is there a significant difference in the level of security measure between the built in security systems and the security applications that can be installed as perceived by the respondents?

HYPOTHESIS

Null Hypothesis: There is no significant difference between the built in security systems and the security applications that can be installed.

Alternative Hypothesis: There is a significant difference between the built in security systems and the security applications that can be installed.

SCOPE AND LIMITATIONS

This study will only focus to the employees of various sectors who use smartphones to help them protect their files, documents and other personal information.

The coverage of the study is about the improvement of privacy in smartphones and its content. It also includes the means on how to avoid different types of invasion of privacy cases. This study includes the security applications that can help to protect their confidential information.

The researchers will be able to discuss about the advantages and disadvantages of using smartphones in terms of invasion of privacy of the users.

The researchers limit its discussion about the different types, models or brands of any smartphone. The researchers will not specify any specific smartphone and the study will only focus on how a smartphone user can protect his/ her personal information. The researchers limit its correspondents only to 100 different employees from private and public sectors.

SIGNIFICANCE OF THE STUDY

This study is beneficial to the following:

Mobile Phone Industry. This study will be beneficial to the mobile phone industry to give them awareness about the efficiency and effectiveness of the security system of their products. The study will greatly help the industry of mobile phones to upgrade or innovate their systems to add up on its value to attract more users and consumers.

Smartphone Users. This study will be beneficial to all smartphone users to help them be aware of what they can do to secure their personal information and if it will happen that they are a victim of invasion of privacy they will know how to stop the circulation of their personal data's.

Academe. This study entails the school to know about the safety applications that they might need for their smartphones and they can be aware about the cases of invasion of privacy.

Students. This study will also be significant to the students who uses a smartphone not only for their social lives but also to keep and store data and documents for the school projects. It will be beneficial to acknowledged the performance of security systems of both built in apps and installed apps on smartphones.

Future Researchers. This study will serve as their reference to the research which is related to in this study. Through this research, the widening of invasion of privacies through the use of smartphones will lessen. It will serve as a guide to awareness that technologies may greatly affect people's privacies nowadays.

DEFINITION OF TERMS

For better understanding of the terms used, below are Operational and Conceptual meanings of the following:

Application – installed programs that can be used to for various purposes.

Built- In Application – are applications that are made by the smartphones companies that are already included and ready to use when buying one.

Computer - an electronic device for storing and processing data, typically in binary form, according to instructions given to it in a variable program.

Confidentiality – secret or private information that are restricted from other people.

Installed Applications – are applications that are not automatically included when buying a smart phone and these are the applications available in play store for android or App Store for Apple. It can either be installed or uninstalled.

Invasion of Privacy – is a legal term. It is used to describe a circumstance where an individual or organization knowingly intrudes upon a person.

Mobile – A cellular phone that is handheld computers.

Personal Information – Data, files and other documents that belongs to a particular person.

Privacy – limitations of the owner to their personal information from publicity.

Security – free from being in danger

Security Application- is the use of software, hardware, and procedural methods to protect applications from external threats.

Smartphones – Mobile phones that has improved features.

Tablets - type of notebook computer that has an LCD screen on which the user can write using a special-purpose pen, or stylus.

Theft- an action or a crime of stealing.

Threat – it may also serve as a warning.

Virus – a threat that may cause destruction to the smartphone.

REVIEW OF RELATED LITERATURE AND STUDIES

This is a review of related literature and studies undertaken which provides an overview and assessment of the highlights, merits and/or shortcomings of previous research which contribute to the evolvement and improvement of the present study.

Local Literature

According to Mendoza, et. Al (2015), accessing individual's private E-mail conversation and computer records, collecting and sharing information about individuals gained form their visit is to Internet Web sites and newsgroup is violation of privacy.

1. **E-mail spamming**, is also known as **unsolicited commercial e-mail (UCE)** involves using e-mail to send or broadcast unwanted advertisement or correspondent over the Internet. The individual who spam their e-mail usually called spammer.

2. Many spammers broadcast their e-mail for the purpose of trying to get people's financial information such as credit card or account bank numbers in order to defraud them. The example of fraud using e-mail is spammers will lure consumers to enter their personal information on fake website using e-mail, forged to look like it is from authorized organization such as bank.

3. **Computer Matching** also referred to as data matching generally involves the computerized comparison of two or more automated systems of records or files. Unauthorized used or mistakes in the computer matching of personal data are another controversial threat to privacy.

4. **Flaming** is the practice of sending extremely critical, derogatory, and often vulgar E-mail messages, or electronic bulletin board postings to other users on the Internet or online services.

5. **Web Spoofing** is an electronic deception relates to the Internet. It occurs when the attacker set up a fake website which almost totally same with the original website in order to lure consumers to give their credit card number or other personal information.

6. **Cyber-squatting** is an activity which a person or firm register purchase and uses the existing domain name belong to the well-known organization for the purpose of infringing its trademarks. This type of person or firm, called cyber-squatters usually infringed the trademarks to extort the payment from original trademark's owner.

7. **Web Bugs.** Tiny graphics embedded in e-mail messages and web pages.

8. **Spywares.** Surreptitiously installed on user's computer.

9. **Cookies.** Tiny files downloaded by Websites to visitor's hard drive.

10. **Accuracy.** Who is responsible for the authenticity, fidelity and accuracy of information? Similarly, who is to be held accountable for errors in information and how is the injured party to be made whole?

Misinformation has a way of fouling up people's lives especially when the party with the inaccurate information has an advantage in power and authority.

1. **Property.** Who owns information? What are the just and fair prices for its exchange? Who owns the channel?

One of the most complex issues we face as a society is the question of intellectual stuff rights. Intellectual Property Rights refer to the legal rights granted with the aim to protect he creations of the intellect.

These rights include industrial property rights, e.g., patents, industrial design and trademarks, and copyrights and related rights. There are substantial economic and ethical concerns surrounding these rights; concerns revolving around the special attributes of information itself and the means by which it is transmitted.

Any individual item of information can be extremely costly to produce in the first instance. Yet, once it is produced. That information has the illusive quality of being easy to reproduce and to share with others. Moreover, this replication can take place without destroying the original. This makes information hard to safeguard since, unlike tangible property, it becomes communicable and hard to keep it to one's self.

Foreign Literature

According to Ara Wanoger, the common and the best built in security applications in a smartphone would be the following:

PASSWORD

Password, a real QWERTY password, is the original way to lock and secure a computer, and is still available to users who want a more robust lock method. And if you encrypt your phone (which most users should), you are required to use either a password or a PIN, so passwords are still used by a good many users on their phones. Passwords are harder to crack, but they're also harder to put in one-handed.

At the very least, they take longer than just about any other lock method, and as much as we unlock our phones, many users simply cannot abide spending an extra two to five seconds pecking out a full-bodied password. We want into our phones, and we want in NOW.

And while Trusted Bluetooth, NFC, and other sensor-based unlock methods can help our phones stay unlocked longer, you will still end up using your traditional lock screen method at least four to five times a day.

So when picking a password, pick something that is hard to guess but easy for you to quickly type out.

PATTERN

The most popular lock method in that poll from the beginning of the month is the pattern lock. It's simple, yet if you use all the dots - or if you can make an even bigger grid for the pattern to be woven through - pattern locks can be pretty secure. Of course, there's always the threat of a smudge trail to lead someone through the pattern - but that encourages you to keep your screen clean and clear. Patterns are also easy to remember through a variety of

methods: you can equate each of the nine dots with the number that would sit there on a number-pad, or you can tie it into the wallpaper that sits behind it.

If you're using something like Muzei, that may not be possible, but for those of you that are more faithful to your wallpapers, it's certainly an option.

PIN

In terms of lock methods, PIN is second only to pattern in popularity.

They're slightly harder to be guessed out by swipes, they can vary in length, and they're easy to copy down in a discreet place if you're the forgetful type.

PINs are also a little harder to use out from the smudges on the screen since they're not connected like a pattern.

They're also one of the lock methods compatible with encrypting your device, and with corporate email apps and other security-sensitive apps, which may contribute to them being quite so popular.

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A WORD ABOUT FACE UNLOCK

Face Unlock has been loitering in Android for a few years now, and it's not very popular, and there are a few reasons for it. First, even a three year old can hack it with Mommy or Daddy's photo, so in a selfie-crazy society letting your mug unlock your phone may not be the best thing in the world. Also, face unlock doesn't work in the dark or any other non-photogenic conditions, do you'll be using the backup method a lot.

According to beebom.com, Android is undoubtedly one of the most popular and widely used smartphone operating system. It comes with tons of unique features making it one of the must love operating systems ever.

However, Security of the smartphone is one aspect where Android lags behind its competitors. Though Android phones come inbuilt with basic security options and allows the user to add a passcode to lock the lock screen, yet it lacks a lot of advanced ones.

One thing, every smartphone user need is to protect their privacy by password which protects some of their apps. Many users use their Android phones for sensitive works and thus it becomes essential to secure the information stored in the app from falling into wrong hands. Also, at times we need to hide our pictures and messages so that no one else could see them. These are some of the best app locker which will allow you to choose the one suiting your requirements and which you can download and install it from your device:

1. Smart App Lock

Smart AppLock is one of the most advance app locker and comes with some really smart features. The users can lock their desired apps either by using a password (PIN/Words) or a pattern.

One of the most distinguishing feature of this app is its ability to take a picture of the person trying to unlock your device (after multiple failed attempts to unlock) and send it to a pre-defined email id (asked at the time of installation)

Moreover, it can be customized to show a fake Forced close popup instead of lock screen, such that the person using your phone will get an impression that the app has crashed and won't be able to know that the app is locked.

2. Apps Lock & Gallery Hider

Apps Lock & Gallery Hider is yet another app in the list which comes with some awesome features. It can password protect almost any app on your phone including Gallery, SMS, Contacts, Gmail, Dialer etc.

To achieve the desired versatility, many mobile devices now run operating systems that allow one to install additional software. Other key features include network connectivity and increased processing and storage capabilities.

Further, many PDAs are equipped with so-called extension-slots, which allow for the addition of extra hardware.

SMARTPHONES

Smart Phones or PDA-phones are the combination of a mobile phone and a PDA. Basically, two variants of smart phones exist: the elaborate version which has the look-and-feel of a PDA, and the more basic version which has the look-and-feel of a mobile phone. As smart phones offer many PDA-like characteristics, they also support the installation of supplementary applications. Very high-end smart phones commonly offer wireless local area or personal area networking capabilities.

Luckily security apps have improved dramatically to keep pace with the new threats, so you have plenty of great protection to choose from. The majority of Android security apps are actually packages that include a host of other tools from contact filtering to remote lock or wipe.

We decided to take a look at the top five Android security apps and find out what they do. We are taking a look at these from a consumer point of view, so be warned that some of the "free" apps are only free for personal, non-commercial use.

1. 360 Security (Free)

A major player in China, developer Qihu burst onto the scene and claimed the top spot in AV-Test's September 2013 report with a virtually flawless detection rate of 99.9 percent, the highest of any of the security apps tested. In the latest March 2014 report it achieved a detection rate of 100 percent. The focus with 360 Mobile Security is firmly on detecting and nullifying threats to your system. It has a very streamlined, elegant design. It's extremely lightweight, and it's completely free.

A standard real-time scan will safeguard your device from malware, spyware, and the threat of infection. It's also capable of detecting and fixing system vulnerabilities and cleaning up idle background apps to help your phone run more efficiently.

There's a privacy advisor and a tool to clear your usage history. The latest version of 360 Security boasts a lot of extras, including a junk file cleaner, memory booster to free RAM, a power saving option, app management, privacy with encryption, and anti-theft tools for locating or remotely wiping your phone. For a good blend of usability and strong protection, you should think about 360 Security. It offers smooth performance and a host of extra features, so it is bound to appeal.

2. Avast! Mobile Security

As a genuinely free app for the Android platform, Avast! Mobile Security is offering an impressive range of tools. It has antivirus protection, it scans your apps to provide details on what they are doing, and it has a Web shield that scans URLs for malware.

There are various additional tools in the package and the best of the bunch is the anti-theft component. The app is actually based on an old app called Theft Aware which Avast acquired. The anti-theft feature is hidden and allows you to remote control your smartphone using SMS. So if you lose your phone, you can remotely lock it, locate it, or wipe it.

You can make it play a siren sound, lock down the SIM card, and prevent USB debugging as well. It's a comprehensive solution for theft protection. If you have a rooted device then there's also a firewall that allows you to control network traffic. You can block access to Wi-Fi or the network for specific apps which is handy for security and potentially saving on battery juice as well.

According to the latest AV-Test report of 31 popular Android security apps, Avast is a solid option with an overall detection rate of 99.9 percent. Although it is not top of the charts in terms of malware detection, the extra functionality (including the anti-theft tools and a firewall for rooted devices) still make it worth considering. It has a light footprint with no discernible drain on battery life and no impact on general performance.

The fact this app is completely free, has a wide range of features, and offers protection for rooted devices, makes it a strong contender. If you're looking for a security solution for your Android smartphone, and your primary concern is malware and safe browsing, then this could be the right app for you.

Avast Marketing Director, Milos Korenko, has assured us that "There might be a paid version in the future but that won't have an impact on the free version. It will continue to be available and loaded with features."

3. Avira Antivirus Security

With a 100 percent detection rate and no false positives, you can trust the free version of Avira to keep your Android smartphone or tablet safe. It has a light footprint in terms of performance and a sleek, minimalist design that fits in well with the Android platform.

Avira allows you to scan apps for potential trouble and it scans new apps or updates automatically. There's also the usual batch of anti-theft tools, to help you find your device remotely, lock it, wipe it, or trigger an alarm.

Local Study

Based on the study conducted by Edward Limuel C. Castro (Smartphone Apps: Shaping and Reshaping Online Journalism; University of the Philippines College of Mass Communication) when news and update are just one click away, one may not bother to purchase newspaper anymore. Small computers such as smartphones or tablets can be one's sources of news nowadays.

With the ever changing media technology, news- gathering is now far easier than ever. There are variety of theses smartphones and tablets that are available for millions of people. Price is not a definitely problem these days because there is a myriad of affordable gadget and gizmos. Manufacturers try to outsell each other by bringing out entry level handsets. Samsung Philippines for example, recently released Samsung Galaxy Pocket, which retails at Php 4,750. LG has its Optimus L3 for Php5,350.

Smartphones and tablets can pack so many features; you can have it all in a single gadget.

A gadget can have a camera, an internet access, a web browser, a radio, a document viewer and other applications that are easy to use. Smartphones and tablets make access to the internet easy through Wireless LAN connectivity or popularly known as “Wi-Fi”, making it easier to go online anytime and almost anywhere. Giant Philippine Telecommunications such as Smart and Globe also offer monthly plans with unlimited Internet access. As a result, more and more people go online every day.

One of the advantages of having a smartphone or a tablet computer is that you can easily download and install thousands of free applications. Applications or “apps” are of different categories. There are security applications, gaming applications, for entertainment, productivity, utility and for news.

Foreign Study

Based on the study conducted by Collin Richard Mulliner (Security of Smartphone, a Master’s Thesis in University of California Santa Barbara), Mobile devices are small, highly portable computing devices. They are often referred to as handheld devices or pocket-sized computers because of the way these devices are operated and transported, respectively.

Early mobile phones along with so-called organizers were the first mobile devices, which started to appear in the late 1970s. Mobile phones, at that time, did not have much in common with current mobile phones, other than the fact that both devices were able to make phone calls.

Similarly, early organizers did not have anything in common with current Personal Digital Assistants (PDAs), other than the capability of keeping an address book or a calendar.

In general, one can say that early mobile devices where designed for one specific application or task, while current mobile devices are designed to be versatile.

To achieve the desired versatility, many mobile devices now run operating systems that allow one to install additional software. Other key features include network connectivity and increased processing and storage capabilities.

Further, many PDAs are equipped with so-called extension-slots, which allow for the addition of extra hardware.

SMARTPHONES

Smart Phones or PDA-phones are the combination of a mobile phone and a PDA. Basically, two variants of smart phones exist: the elaborate version which has the look-and-feel of a PDA, and the more basic version which has the look-and-feel of a mobile phone. As smart phones offer many PDA-like characteristics, they also support the installation of supplementary

applications. Very high-end smart phones commonly offer wireless local area or personal area networking capabilities.

MOBILE DEVICE HARDWARE

The hardware used by most mobile devices is fundamentally different from the hardware used for personal computers. The reasons for this are the specific size and functionality requirements of these devices, like power-efficiency.

Most mobile devices are based on so-called application processors, which not only include a central processing unit (CPU) but also the required memory and peripheral controllers.

Application processors are complete platforms that are customized by the actual device manufacturer.

These customizations include: memory size, display and touchscreen, connectivity (e.g., wireless LAN), and specialized digital signal processors (DSPs) for multimedia processing.

WIRELESS TECHNOLOGIES

Wireless technologies play an essential role in the field of mobile devices, since they changed the perception of these devices in a fundamental way.

This section first shows why and how wireless technologies play such an important role in the mobile device world, and then it presents the different wireless technologies.

THE ROLE OF WIRELESS

Wireless technologies have not only taken an important role in mobile device usage: they have changed the whole concept of mobile devices in a way no other technology did before.

Mobile phones would not exist without these technologies, but enhanced data communication technologies like GPRS have had a major effect on mobile phone capabilities, since these are the basis for services like MMS and mobile-phone-based Internet access.

The devices with multiple wireless interfaces, like smart phones, show especially well the major role of wireless technologies in mobile device usage.

A smart phone which includes wireless LAN and mobile phone capabilities makes it very easy to be connected at all time, therefore, making access to online resources easier than ever.

Nowadays, a mobile device without any kind of wireless connectivity would be considered almost useless (special cases like media players are notable exceptions). Wireless technology is ubiquitous and people want to access the Internet from any place at any time.

In summary, wireless technologies have a major impact on the world of mobile devices. They increased the attractiveness of mobile devices for a broader group of people and they raised the usage frequency of these devices.

SPECIAL MOBILE DEVICE APPLICATIONS

There are a couple of special applications only found on mobile devices, like applications that determine the look-and-feel of a mobile phone (in case the device also has mobile phone capabilities). This section provides a brief overview of these special applications.

The most important application is the **synchronization application**. As the name suggests, the application is used for synchronizing data stored on the device with data stored on a personal computer or server.

In addition, these applications are also used for installing additional software or modifying system parameters (e.g., the system clock).

Often synchronization-frameworks provide additional features, like access to the mobile device's file system and remote debugging facilities. Another application handles the different wireless interfaces.

This application is basically used for configuring the interfaces and the services that are bound to them. While this kind of application is commonly found in networked environments, the mobile device versions usually support time-dependent con- figuration settings and "routing" based on the costs associated with an interface (often this is interchangeable with the amount of bandwidth)

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MOBILE DEVICE SECURITY

The security issues of mobile devices are different from the security issues of personal computers and servers. Understanding these differences is important in order to understand mobile device security. This chapter provides a survey of mobile device security issues.

Mobile device security has five key aspects that distinguish it from conventional computer security: Mobility, Strong Personalization, Strong Connectivity, Technology Convergence, and Reduced Capabilities.

Mobility. Mobile devices are mobile. They are not kept in one place which may be secure, and, therefore, they might get stolen and physically tampered with.

Strong Personalization. Mobile devices are normally not shared between multiple users, while computers often are. Devices are kept close to their owner.

Strong Connectivity. Many devices support multiple ways to connect to a network or the Internet.

Technology Convergence. Current mobile devices combine many different technologies in one single device, like a PDA, a mobile phone, a music player, and a digital camera.

Reduced Capabilities. Mobile devices are computers but lack many features that desktop computers have. For example, a mobile device does not have a full keyboard and has limited processing capabilities.

By putting all of the aspects together it can be seen why mobile device security is more complex than normal computer security. Mobility, for example, increases the risk of data theft, because stealing a mobile device is a lot easier than breaking into a computer.

Strong Personalization together with Strong Connectivity increases the threat of privacy violations (a device is where the owner is, and, therefore, locating the device means locating the owner).

Technology Convergence leads to additional security risks. Every additional feature adds at least one new target that can be attacked. Reduced hardware capabilities may facilitate certain kinds of Denial-of-Service attacks (e.g., attacks that have the goal of rendering a device temporarily unusable). In addition, missing features, like the lack of a full keyboard, complicate the implementation of effective authentication mechanisms (e.g., username and password). All these aspects bear further implications, like increased complexity when conducting security audits of mobile devices.

THREAT MODEL

When trying to secure a system it is necessary to know what kinds of threats to the system exist. A threat model identifies the threats a system is exposed to, the assets to be protected, the characteristics of the attackers, and the possible attack vectors. In principle, the security of mobile devices deals with the same issues conventional computer security deals with: Confidentiality, Integrity, and Availability.

Confidentiality means privacy, that is, it determines who is allowed access what.

Integrity identifies who is allowed to modify or use a certain resource.

Availability describes the requirement that a resource be usable by its legitimate owner.

When looking at the security of a system, it is important to identify what has to be protected; that is, what the assets that need to be secured are. Second, the adversaries must be identified; that is, who poses a threat to the assets.

Third, one has to determine what attacks are possible. Often one kind of attack can be used for gaining access to multiple assets. We identified three classes of assets or targets for mobile devices: Data, Identity, and Availability.

Data. Mobile devices are devices for managing data. Therefore, mobile devices normally contain sensitive information, like authentication credentials, activity logs (e.g., phone usage or calendar entries), and commercial or private information (e.g., pictures or audio-memos).

Identity. Mobile devices, and especially devices with wireless connectivity, are strongly personalized. That is, a device or its content are directly associated with a specific person.
For example, a device with mobile phone capabilities is tied to the owner of the mobile phone service contract.

LOSS OR THEFT DEVICES

If a device gets lost or is stolen, confidentiality is broken. Integrity might be damaged if the device reappears after a period of time.

In this case, someone could have installed spyware or added a physical bug to the hardware and thus tampered with the device's integrity. During its absence the device is, of

course, not available to its legal owner, although it is likely that a critical device would be replaced quickly after it goes missing.

Losing or getting a device stolen is not specific to mobile devices: it also happens to laptop computers (these actually are just bigger mobile devices) and other computer hardware, like hard disks or flash-memory sticks.

However, mobile devices are more likely to disappear since they are small and constantly carried around by their users.

WIRELESS ATTACKS

There are many different attacks which leverage the wireless connectivity of the target.

The most common one is eavesdropping on wireless transmissions to extract confidential information, like usernames and passwords.

Eavesdropping is not a specific attack against mobile devices but mobile devices are particularly vulnerable, because they often only support communication through a wireless connection. Another form of wireless attack abuses the unique hardware identification (e.g., wireless LAN MAC address) present in all wireless transmissions for tracking or profiling the owner of the device. This kind of attack leverages the strong personalization of mobile devices and is specific to mobile devices.

BREAK- IN ATTACKS

Break-ins are attacks where the perpetrator manages to gain partial or full control over the target. Break-in attacks basically exist in two flavors, code injection and the abuse of logic errors. Code-injection is achieved through exploitation of programming errors which lead to buffer overflows or format string vulnerabilities. The abuse of logic errors is more subtle, since a particular logic error is very specific to the application or device that is being attacked.

Break-in attacks have an impact on the confidentiality, the integrity, and the availability of a device. The real threat posed by a break-in strongly depends on the goal of the attacker. In general, break-ins are actually preparing the ground for other attacks, like overcharging, data, and identity theft.

VIRUSES AND WORMS

Viruses and worms are threats to mobile devices as they are to normal computers. They destroy data and render the infected systems unusable. Worms that target smart phones might also have a cost if they spread by using a service where the user is billed for each transfer (e.g., MMS).

In this case, a worm sending itself to hundreds of mobile phones could cause substantial financial damage to the owner of the infected device.

Viruses targeting both the mobile device and the desktop computer are also possible.

These viruses would initially infect a mobile device (maybe using a wireless connection) and would later spread to a desktop computer (e.g., during synchronization).

This kind of virus or worm could easily bypass security mechanisms configured only for detecting external attacks. Other types of malware could monitor and report the user's phone activity, by sending weekly or daily reports (e.g., every time the user connects to the Internet using GPRS)

OVERCHARGING ATTACKS

An overcharging attack is an attack which involves a paid service of some kind, for example a mobile phone service agreement. The goal is to charge additional fees to the victim's account, and, if possible, transfer these extra fees (money/credits) from the victim to the attacker. An example of an overcharging attack is described in.

In this specific case, an attacker leverages a flaw in the GPRS system to overcharge other customers of the same phone service provider. The attack utilizes the always on characteristics of GPRS (which is billed by the amount of traffic instead of the usage time).

The only thing the attacker needs to do is to send random traffic to the IP-address of the victim. The provider would not check if the traffic was requested by the victim or not, and bill the victim for it. Here, a break-in attack is used to initiate a phone call from the victim's device to a possibly expensive phone number belonging to the attacker.

An attack like this is especially attractive for an attacker, because it offers the possibility of generating revenue. Overcharging attacks are very specific to wireless mobile devices, since many wireless services are regulated by pay-per-use contracts.

SMARTPHONE SECURITY

Previous studies on mobile and smart phone security have looked at different aspects of these devices. Most work was done on Bluetooth, the Short Message Service (SMS) and the Wireless Application Protocol (WAP).

Mobile Malware

Mobile malware like viruses, worms, and Trojans have become relatively widespread during the past years, targeting all common mobile operating systems.

Smart phone operating system, already faces multiple viruses, worms and Trojans. Also it was shown that key loggers and back doors are likely to appear on devices.

Methods of Research

This presents detailed idea about the research to be conducted. This includes the research design and research locale, respondents of the study, research instrument used, data gathering procedures and statistical treatment of data.

Research Design

This study made use of the descriptive research method which is designed for the researchers to gather information about existing conditions indeed in the chosen field of study. This method enables the researchers to interpret the theoretical meaning of the findings and hypothesis development for further studies.

Descriptive research method means used to describe characteristics of a population or phenomenon being studied. It does answer the question about how, when and why the characteristics occurred. The characteristics used to describe the situation or population is usually some kind of categorical scheme also known as descriptive categories.

The main goal of this type of research is to describe the data and characteristics about what is being studied.

Research Locale

The setting of the subject study will be the employees from various sectors in Manila.
The respondents involve in this research focused among the employees from various sectors which is not limited to Business Processing Outsourcing (BPO), Banking and Finance company, Marketing company and a Government office.

RESPONDENTS AND SAMPLING TECHNIQUES

The target respondents are divided into four groups: BPO **25;** Banking and Finance company **25;** Marketing company **25;** Government offices **25;** or a total of **100** respondents were all employees in Manila.

Due to the number of the employees, the researchers will be using purposive to form sampling strategy.

RESEARCH INSTRUMENT USED

In gathering the facts in this study, the researcher made use of the followings:

Survey Questionnaire- The researchers revised the survey questionnaire that allows the collection of large amount of data from a sizeable population in highly economical way, unstructured observation and structured interview.

Documentary Analysis- Vital data and basic information relevant to the study were gathered initially using documentary analysis. These data and information serves as a foundation in formulating the theoretical framework including research paradigm and certainly as basis of developing the survey questionnaire.

Interview- An unstructured interview was used to accomplish one very important purpose – that of seeking more information to reinforce the data gathered through the questionnaire. Furthermore, the tool was used to supplement materials gathered through the questionnaire and to countercheck the information given in written form.

Tabulation- the researchers also use tabulation as an instrument for this research because through this, it can make the readers understand more about the data that the researchers included.

Rows are horizontal arrangements. Rows are horizontal in arrangements where columns are vertical in arrangements.

The implications of factors of a Smartphone Users are rated as:

Obtained Weighed Mean		Verbal Description
5	4.01 – 5.00	Strongly Agree
4	3.01 – 4.00	Moderately Agree
3	2.01 – 3.00	Agree
2	1.50 – 2.00	Disagree
1	1.00 – 1.49	Strongly Disagree

The researchers prepared questions in a checklist format for more accuracy and for better understanding in answering the data.

DATA GATHERING PROCEDURE

The following steps will be undertaken by the researchers in gathering data:

1. Ask permission to the smartphone users to conduct a survey for research purpose/s.

2. Preparation of our instruments for our research to know the factors that affect customer satisfaction. Questionnaire is a variable that needs to be approved by our advisor to be certified that it's valid.

3. Questionnaires are ready to be given to the respondents by the researchers to be answered at a certain period of time.

4. After collecting the questionnaires, the data was collated, tallied and subjected to statistical treatment of data.

STATISTICAL TREATMENT OF DATA

Through the use of statistical software, convenient data processing and adjustment is made possible. The following tools and techniques were used in this study:

1. **Frequency count and percentage.** These two descriptive measures were used in presenting the profile of the respondents in terms of the following demographic variables: category of respondents in terms of the following demographic variables: category of respondents; gender; age; civil status; educational attainment and length of service. Percentage was calculated using the following formula:

$$P = F/N (100)$$

Where :

P = Percent F = Frequency of a category N = Total number of cases

2. **Weighted Mean**. This particular measure was used in determining the typical assessment of the respondents Weighted mean was calculated following formula:

WM = ∑fx /N

Where:

WM = Weighted Mean

∑fx = Sum of the frequency and and weight of a response

F = frequency of a response

X = weight of a response

N = total number of cases

3. **T-test**

Tcomputed = $\frac{(\bar{X}-\mu)\sqrt{n}}{S}$

Tcomputed = $\frac{\bar{X}_1-\bar{X}_2}{\sqrt{\left[\frac{[S_1^2(n_1-1)]+[S_2^2(n_2-1)]}{n_1+n_1}\right]\left[\frac{1}{n_1}+\frac{1}{n_2}\right]}}$

Computation : $\frac{\bar{X}_1-\bar{X}_2}{\sqrt{\left[\frac{[S_1^2(n_1-1)]+[S_2^2(n_2-1)]}{n_1+n_1}\right]\left[\frac{1}{n_1}+\frac{1}{n_2}\right]}} = \frac{\bar{X}_1-\bar{X}_2}{\sqrt{\frac{S_1^2}{n_1}+\frac{S_2^2}{n_2}}}$

Tcomputed = $\frac{3.933-3.96993}{\sqrt{\frac{0.03192}{100}+\frac{0.021268}{100}}}$

= 0.1734

Tcritical= Ttabular

α(level of significance)= 0.05

degrees of freedom= 198

Ttabular= 1.96

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

This contains information about the results of the study, the analysis and the interpretation of data gathered with the use of adapted statistical measures. The presentation includes a narrative discussion of the results and implications of the data gathered which are illustrated in tables.

Problem No. 1. What is the profile of employees as respondents in terms of:

1.1 Age

Table 1 shows the distribution of respondents according to age.

Table 1

Assessment of Respondents as to Age

Age	F	%
33 and above	13	13
28-32	31	31
23-27	52	52
18-22	4	4
TOTAL	**100**	**100**

Table 1 shows that 52% of respondents belongs to 23-27 years old, 31% belongs to age 28-32, 13% for the 33 and above years old and lastly, the remaining 4% belongs to 18-2 years old with a total of 100 employees from the different agencies.

1.2 Gender

Table 2 shows the distribution of respondents according to gender.

Table 2

Assessment of Respondents as to Gender

Gender	F	%
M	51	51
F	49	49
TOTAL	**100**	**100**

Moreover, the table also shows that the population of the male respondents is 2 more than the female respondents. This is illustrated on the figure above. The figure shows that the male employees outnumber the female, 51% to 49%.

1.3 Civil Status

Table 3 shows the distribution of respondents according to their Civil Status.

Table 3

Assessment of Respondents as to Civil Status

Civil Status	F	%
Single	50	50
Married	50	50
Widow/ Widower	0	0
Legally Separated	0	0
TOTAL	100	100

The table above shows that out of 100 employees, 50% are married and another 50% are single.

Problem No. 2: What is the level of security do smartphones provide as perceived by the respondents when categorized in terms of the following:

2.1 Built- In Application

Table 4

Perception of the respondents on the Security measures that smartphones provides when categorized as Built in Application

Security Measures	Built in App	Interpretation
	Weighted Mean	
Security	3.92	MA
Consistency	3.77	MA
Effectiveness	3.81	MA
Availability	4.23	SA
Accuracy	4.13	SA

As shown in Table 4, the respondents expressed that out of 100 employees in the various sectors **Moderately Agreed** with a rating of 3.92 weighted mean as varied on the category which is the **Security** of Built- In Applications on the smartphones.

Meanwhile, the respondents revealed that they **Moderately Agreed** with a rating of 3.77 weighted mean on the **Consistency** of Built- In Applications.

On the other hand, the **Effectiveness** of the Built- In Applications was rated by the employees and showed that they **Moderately Agreed** with 3.81 weighted mean.

On the category of **Availability** of Built- In Applications of smartphones, the employees rated that they were **Strongly Agreed** in a 4.23 weighted mean.

Lastly, the respondents stated that they were **Strongly Agreed** on the **Accuracy** of Built- In Applications on smartphones in a 4.13 weighted mean.

2.2 Installed Application

Table 5

Perception of the respondents on the Security measures that smartphones provides when categorized as Installed Application

Security Measures	Installed App	
	Weighted Mean	INTERPRETATION
Security	4.04	SA
Consistency	3.68	MA
Effectiveness	3.68	MA
Availability	4.06	SA
Accuracy	4.06	SA

As shown in Table 5, the respondents expressed that out of 100 employees from various sectors **Strongly Agreed** with a rating of 4.04 weighted mean on the **Security** of Installed Applications category.

The respondents also **Moderately Agreed** with a rating of 3.68 weighted mean about the **Consistency** of Installed Applications of the smartphones.

At the same time, the respondents indicated that they also **Moderately Agreed** with 3.68 weighted mean on the **Effectiveness** of Installed Applications.

Simultaneously, they also demonstrated that on the **Availability** of Installed Applications on smartphones that they **Strongly Agreed** with a weighted mean of 4.06.

While on the **Accuracy** of Installed Applications, they conveyed that they also **strongly agreed** with a rating of 4.06 weighted mean.

Problem No. 3: Is there a significant difference in the level of security measure between the built in security systems and the security applications that can be installed as perceived by the respondents?

Table 6

Significant difference in the level of security measures of built in app and app that can be installed as perceived by the respondents

t-computed value	t-critical value	Decision	Interpretation
0.1734	1.96	Accept the	There is a

As shown in Table 6, the respondents revealed that there is a significance difference between the Built-In Applications and Installed Applications in terms of security and effectiveness and the decision has led to accept the **Alternative Hypothesis** with the T-computed value of 0.1734 and a T-critical value of 1.96.

SUMMARY OF FINDINGS

The study used the descriptive method utilizing the survey questionnaire as the data gathering instrument. The data gathered were statistically analyzed using the following tools: frequency count and percentage distribution, weighted mean and t-test.

The findings of the study are as follows:

One hundred (100) respondents have responded to the questionnaires provided for the survey. Survey was conducted to determine the difference between the Installed Security Applications and Built-In Security Applications in terms of: (see table No. 5)

- Security

This was assessed that Built – In Application is rated 3.92 weighted mean while Installed Application is rated 4.04 weighted mean. Installed Security Application was rated Strongly Agree while Built- In Security Application were rated Moderately Agree by the respondents.

- Consistency

This was evaluated between the Built-In Security Application that has a weighted mean of 3.77 and Installed Security Application that has 3.68 weighted mean. Therefore, consistency was rated as Moderately Agree by the respondents in both applications.

- Effectiveness

This was assessed that the Built- In application has a weighted mean of 3.81 and on the other hand, Installed application has a weighted mean of 4.01. Built- In Security Application

was rated Moderately Agree while Installed Security Application was rated Strongly Agree by the respondents.

- Availability

This was interpreted that Built- In application has a weighted mean of 4.23, then Installed application has 4.06 weighted mean. This shows that in the category of Availability for both applications, were rated Strongly Agree by the respondents.

- Accuracy

This was evaluated between the Built- In Security Application that has a weighted mean of 4.13 and for Installed Security Application that has 4.06 weighted mean. This shows that both applications were rated as Strongly Agree by the respondents.

CONCLUSIONS

Based from the findings of the study, the following conclusions are hereby drawn:

1. Respondents are almost divided by half in terms of gender, while most of them fall under the age bracket of 23-27 years old and all are single.

2. Installed Application has a better security and effectiveness level rather than Built- In Security Applications. Respondents prefer using Installed Applications because it is trusted by the users and is examined and enhanced by the company itself.

3. There is a significant difference between Built- In Security Application and Installed Security Application, based on the survey, respondent sees Installed Application has a higher level of security and effectiveness.

RECOMMENDATIONS

Based from the conclusions, the following recommendations are offered:

1. System developers must improve Built- In Security Application to satisfy and reach the Security and Effectiveness level of Installed Application. They must provide a better and accessible lock to the user to assure the security of the smartphones.

2. Provide the users a system that synchronizes the data and information of a particular owner of a smartphone that can help them ensure their security and to serve as back-up plan in case of destruction of a security application.

3. Ensure the users that they can keep their files confidential by using security applications and prevent from different types of invasion of privacy.

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A FILIPINO MODEL OF TEACHING EXPERTISE IN HIGHER EDUCATION

Enrico Lingad

INTRODUCTION

Quality education is first and foremost a function of instruction because in the hands of uncommitted and ineffective teachers, even the best-designed curriculum is doomed to fail. While is it true that some student can learn in spite of the teacher, it cannot be denied that the quality of the outputs of education is a function, to a great extent, of instruction and of students interaction with their teachers.

Educational institutions that have distinguished themselves for excellence take pride in a cadre of expert teachers who view teaching as a service oriented mission, an opportunity and a privilege for sharing their expertise and humane qualities wholly and unconditionally. These are teachers who empowers learners to achieve the goals of education – teachers whose personal traits, attributes, and teaching practices have inspired a great expanse of theoretical and empirical literature for almost a century.

From early 50s to the late 2000s, research on teaching focused on teachers' effectiveness. Studies were generally concentrated on the identification of traits and attributes most and least preferred of teachers by students, teachers educators, and school administrators. However in the 60s and the 70s researchers realized that studies on teaching effectiveness could not be confined to the narrow dimension of teacher traits or attributes. It did not identify the best teaching practices, and instead produced the erroneous impression that teachers are born. Consequently, the attention of researches are shifted to the identification of classroom teaching practices (e.g., observing wait-time in questioning, giving feedback, using praise) were averaged across observations and correlated with teaching outcomes, usually measured by students' scores in standardized tests. These so-called "process-product" studies on teaching dominated the literature for several years, reaching its peak in the late 60s to the early 70s (Shulman 1992). However just like the earlier investigations on teaching effectiveness the limitations of this type of research became apparent. After reviewing the research literature on teaching effectiveness, which spanned almost two decades Shulman (in Brandt 1992, p.20) concluded "the image of teaching found in process-product literature was quite narrow." In the same vein, other researchers acknowledged that tests inadequate for measuring learnings outcomes and that process-product researches did not provide the "more subtle points that distinguish the most outstanding teachers" (Brophy 1992, p.5) Inevitably, enthusiasm in process-product studies waned and a reorientation of studies on teaching followed.

The attention of researchers shifted from quantitative investigations of possible relationships between teaching practices and students academic achievement to qualitative analysis and documentation of teaching particular subjects and topics (Brophy 1992; Elmore 1992; Prawat 1992; Shulman 1992;) This view was shared by other educational researchers who proposed the intertwining of responsibility and effectiveness as a criterion for research on teaching, particularly on expert teaching (Oser, Dick, & Party 1992; Shavelson 1992.

Expert teaching is effective and responsible teaching (Berliner 1992). Teaching is effective, according to him, if it meets some criteria or standards of performance, usually in terms of students' academic achievement. It is responsible if it is based on mutual respect between the teachers and learners, and if it enables the learners to become active, responsible participants and "co-creators" of learning.

Salomon (1992) describes responsible teaching in terms of the following observable teaching practices: (a) proper carrying out of the teacher's role as an orchestrator, catering to different students; (b) assuming responsibility for the learning process and outcomes, while at the same time judiciously shifting learning responsibility to students; and (c) serious consideration, selection, and design, as contrasted with mindless adoption, of instructional means, activities, materials, tasks, and the like in the light of normative and moral criteria.

Certain attributes have been ascribed to expert teachers. They place a high premium on the development of student thinking and understanding (Eisner 1992). They work beyond what is ordinarily required of a teacher; "willing to work the extra mile and go the extra mile" in their desire to be the best teacher they can be (Ready, in Woolfolk 1998. P. 21) They intuitively use what works; experience very few interruptions or delays, "turn students' confusion into understanding", "improvise explanations and create new examples on the spot" (Greeno 1986; Woolfolk 1995). Expert teachers have also been described as possessing project matter expertise, classroom management expertise, instructional expertise and diagnostic expertise (Weinert, Helmke & Schrader 1992).

> Subject matter expertise refers to content mastery and the organizations of content-specific knowledge that facilitates effective instruction (Berliner 1986; Grossman, Wilson & Shulman 1989; Leinhardt & Smith 1985; Shulman 1987; Tamir 1988; Weinert, Helmke & Schrader);
>
> Classroom management expertise is defined in terms of maintenance of high levels of on-task learning in the classroom, prevention or speedy elimination of learning environment conducive to learning (Berliner 1986; Doyle 1986; Evertson 1989; Weinert, Helmke & Schrader);
>
> Instructional expertise refers to implicit and explicit teachers' knowledge of different teaching strategies and methods to attain instructional objectives and skills that result in well-organized, competent, and dynamic teaching (Weinert, Helmke, & Schrader);
>
> Lastly, diagnostic expertise refers to teacher's knowledge of class and individual needs and goals, abilities, achievement levels, motives, personality attributes, and emotions, which influence instruction and learning (Clark & Peterson 1986; Leindhart 1983; Schrader 1989 in Weinert, Helmke & Schrader 1992).

Compared with teaching effectiveness research relatively fewer studies have been done on teaching expertise. Two such studies were separately conducted by Eisner (1992) and Rollett (1992). Eisner visited the classrooms of two third-grade teachers who were reputed experts, and attribute their expertise to their "affectionate" interaction with the learners, and to their efforts in developing pupil responsibility and seriousness in learning. On the other hand, Rollet compared experienced and reputed excellent teachers in three cities: New York, London and Vienna. Just like Eisner's exemplary teacher respondents, Rollet's dozens of exemplary teachers were concerned not only with the cognitive development of students, but with their affective development as well. Both researchers concluded that expert teachers are effective, as measured by attainment of curriculum goals, and learner-centered.

Another study on teaching expertise was conducted by Rowles (1991) among 40 secondary teachers in one large school district in British Columbia. Based on content analysis of the participants' explicit and implicit descriptions for their teaching, he concluded that paying

attention to what was implicit in teacher talk could yield new insights about expert teaching practice.

The aforecited studies were all descriptive in nature. None of those dealt on theory building, an under researched area in the field of education. As noted by Beauchamp (1981 p.3) "educators have been concerned with empirical data of all kinds, but they have been unable to make use of the conceptual processes of science in the development of theories". He surmised that this might be attribute to their lack of interests and capability in doing theory-building research.

A theory building research on teaching, developed by Lundgren (in Beauchamp 1981), had 3 components: frame factors (goal and content of the curriculum), teaching process, and learning outcomes. He studied the effects of the frame factors on the teaching process and on the resulting learning outcomes. In the local setting, Reyes (1998) explored the development of teaching-learning theory based on an integrative review of brain research, mostly consisting on doctoral dissertation. In the area of educational management, Batacobe (1998) proposed a model of effective management of diocesan schools in Lucena, based on a qualitative analysis of commonalities among administrators of effective school, which were not found among administrators of ineffective schools.

Model building is relatively an unpopular research option especially among educational researchers, hence, the present study many inspire replications and related studies among teacher experts in other settings, thereby contributing to the limited empirical literature in this field. Furthermore, in the words of Shulman (1992, p.14), "Teaching is and has always been at the center of all education and educational reform"; thus, any research that focuses on teaching is significant, especially if it provides an empirical base that can guide policy actions concerning teachers.

The present study was designed to identify the components of teaching expertise based on selected teacher-related factors and conditions, which were perceived by expert Filipino teachers as having contributed the most to their success in teaching. Teacher-related factors were limited to personal and professional variables, such as age, gender, martial status, brain dominance, first career choice, academic performance on school, educational background and field of expertise, length of teaching experience, and educational philosophy.

The choice of teaching experience was prompted by fragmentary evidence and anecdotal records which indicate that teachers require at least 5 years of teaching experience in order to acquire teaching expertise (Berliner 1992). According to Berliner, even if not all experienced teachers are experts, it is unlikely for many teachers to attain expertise without extensive teaching experience. The average length of teaching experience of the local expert teacher participants was determined in the present study to find out if it would be one of the descriptive characteristics of expert Filipino college teachers.

The choice of educational philosophy, on the other hand, was inspired by Wiles and Bondi (1994) who believe that the wide range of differences among teachers, especially with regard to the selection of teaching strategies and their behavior towards student can be explained by differences in their educational philosophies. Would the expert teachers be inclined towards the more flexible or unstructured educational philosophies that are centered on the needs of society and of the learners or, would they tend to favor the more structured or traditional philosophies?

Another factor that may possibly influence the way a teacher handles the teaching-learning process is his or her brain hemisphericity. A person may be left-brained (i.e.,

analytical, logical, rational, structured, serious/formal), right-brained (imaginative, intuitive, unstructured, playful/humorous) or mixed brained (the ideal). A mixed-brained person can easily shift gears from left-brained to right-brained information processing modes at will. Would it be likely therefore for expert teachers to be mixed-brained? This explains the inclusion of this variable in the present investigation.

Another variable of interest in the study, relative to the profile of expert teachers, was their educational background. Were they product of teacher-training institutions? Was teaching their first career choice? Differently stated, could a person become an expert teacher even if he or she did not have a formal training in teaching and did not initially intend or wish to become a teacher? Were they academic achievers during their schooling, which would refute the thinking of some Filipino parents that teaching is for those who are lacking in intelligence? Did they actively participate in non-academic pursuits such as extra-curricular activities, athletics, and student organizations?

From other perspective, would there be preponderance of male or of female expert teachers; of single or of married expert teachers?

The ideas and concepts that guided the conduct of the present study are summarized and schematically presented in Figure 1. It presents the input data, the data analysis, and the expected results or outcomes of the analysis.

THE PROBLEM

This study was primarily aimed at the development of a Filipino model of teaching expertise in higher education to guide policy making concerning teachers.

Specifically, the study was designed to answer the following problems:

1. What is the profile of expert teachers in Philippine higher education with regard to selected personal and professional variables?

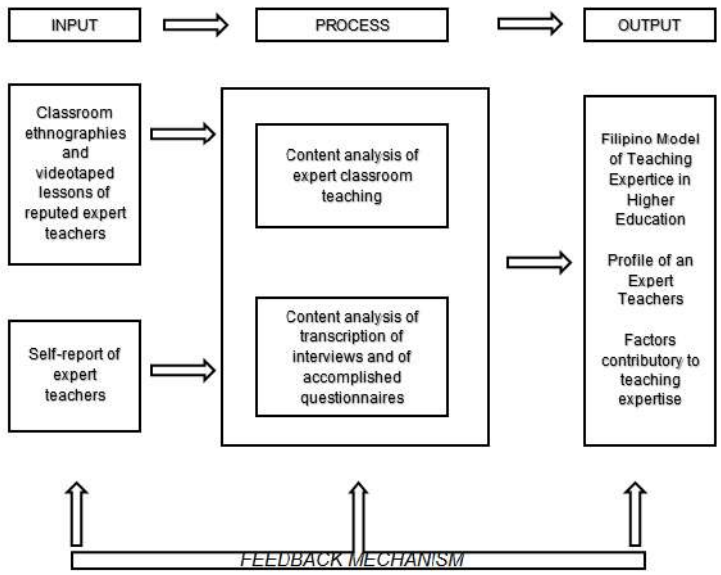

Figure 1. Paradigm on the Development of a Filipino Model of Teaching Expertise in Higher Education

2. Based on the profile and self-reports of the expert teachers, what factors contributed to the attainment of teaching expertise?

3. Based on qualitative and quantitative content analysis of ethnographic classroom observations and videotaped lessons of reputed expert teachers, what model of teaching expertise may be developed in the context of Philippine higher education?

4. What are the implications of the study for policy making concerning teacher preparation, testing, development, promotion, retention, and tenure?

METHOD

A purposive sample of 69 reputed expert teachers from 40 higher educational institutions distributed in State Colleges and Universities in the National Capital Region (with the exception of the University of the Philippines and EARIST) participated in the study. Twenty-eight of these teachers were Metrobank awardees, 32 were teaching courses in Level 3 accredited programs, and another 9 were from Centers of Excellence (COEs).

Of the 40 participant schools, 34 were private and 6 were government-owned. Only five (12.5%) were located in the rural areas.

Multiple techniques, i.e., face-to-face interviews, use of survey questionnaires, videotaping of classes, class observations, and classroom ethnography were employed for gathering and cross validating data. Classroom ethnography is a descriptive approach that involves making "detailed observations in teachers' classes" (Woolfolk 1998).

Three survey instruments were used in the study, to wit: (a) the Knowing Yourself – Right or Left as adapted by Reyes (1994) for Filipino respondents to determine brain dominance; (b) the Philosophy Preference Assessment of Wiles and Bondi (1994) to determine a person's educational beliefs, assumptions, and convictions relative to 5 major philosophies: Perenniallism, Idealism, Realism, Experimentalism, and Existentialisms; and (c) a researcher-made survey questionnaire for expert teachers.

PROCEDURE

The researcher and four field researchers (tertiary-level school administrators whose functions included classroom observations and teacher evaluation) conducted interviews and ethnographic observations of the participant teachers. The videotapes of the classes of the teachers' participants, taken by professional video technicians, served to validate the classroom ethnographies.

Schedule class observations and videotaping ranged from 1 hour for Monday-Wednesday-Friday classes, 1.5 hours for Tuesday-Thursday classes, and 3 hours for once-a-week classes. In most cases, the class observer and the video technicians would visit the class of an expert teacher twice. During the first session, the technician would pretend videotaping the class, to familiarize the students with the process, before the actual taping on the second class meeting. However, due to time constraint, especially for classes that met for three hours once a week and, in isolated cases, as requested by participants, class observation and videotaping were simultaneously done during only one class session. That the presence of a

field researcher and at least one technician could have affected the students' classroom behavior and performance is acknowledged as a possible limitation of the study.

Before or after the class observations, the field researchers conducted unstructured interviews of teachers to gather more in-depth information related to the open-ended items of the questionnaire. The transcriptions of these interviews; the accomplished survey forms; the classroom ethnographies supplemented by audiotapes, and videotapes together with verbatim transcriptions of teachers-student verbal interactions, were content analyzed in the light of the purpose of the study.

RESULTS

Profile of the Expert Teachers

The oldest participants was 79 years old, while the youngest was 23. It is worth noting that a teacher can earn recognition as an expert at the early part of his or her career. This indicates that some are born teachers. However, this is more of an exception rather than the rule because the median age of the sample was 50 and the majority (82.6%) were over 40. Moreover, one-fifth of the experts were in the 60 to 79-age bracket. One significant inference that can be deduce from these data is that the teaching performance of expert teachers does not deteriorate with age.

This is information lend support to the practice of extending the services of excellent teachers beyond retirement age.

Of the 69 teachers, only 24 (including a nun and a priest) were single. This indicates that having a family is not a hindrance to success in teaching. In fact, self-reports of the married expert teachers affirmed that having understanding and supportive spouses and children contributed to their success in teaching.

The experts initially did not want to become teachers. After graduating from high school, only 26 actually opted for a teaching career. The rest would have been researchers' journalist, lawyers, engineers, doctors, nurses, TV hosts, priests or pastors had their early career plans materialized. Based on these findings, it may be inferred that an initial liking for teaching may be contributory, but not essential to the attainment of teaching expertise. In contrast, all of Adam's veteran outstanding teacher really wanted to become teacher long before they went into teaching.

An intriguing finding is that only 10 of the participants were graduates of teacher-training institutions. Stated differently, 85.5% of the expert teachers did not have a formal undergraduate education and training in teaching. This leads us to ask, "If teachers can attain expertise in their work without benefit of studying in a teacher training institution, what difference then do such institutions make, in preparing future teachers for a successful teaching career?"

Another significant finding is that no one among the expert teachers who went through teacher training institutions attribute his or her attainment of outstanding teaching performance to his/her undergraduate education. One questions that may be posed therefore is, "Can in-service training and other professional activities pursued by teachers in the long run, provide the same preparation that teacher education program offer?" Or, "What is the true worth of such programs?"

If an undergraduate program in education us not a prerequisite to successful teaching, what about scholastics performance or, participation in co-curricular activities during college? During their undergraduate years, 58 of the expert teachers were academic achievers. Of this group, 33 were among the top performers, although they did not make it to the Dean's list, and 25 were either consistent honor students or, Dean's listers. On the other hand, only 11 were average performers. These data suggest a possible relationship between academic achievement and teaching performance. It does not mean though that an average college student who wishes to go into teaching will not succeed, as verified in the study. The fact remains, however, that the high achievers far outnumbered the average performers in the sample of expert teachers, and that no one among them was below average during schooling. This findings runs counter to the thinking of most Filipino parents that teaching is the right choice for low performing children. It is also negates the impression that bright teachers, especially those who graduated with honors, cannot be as patient as their less intelligent peers.

The lengths of teaching experience of the participants varied from 2 years to 47 years, with a median of 25 years. This finding lends support to the thinking of Berliner (1992) and Adam (1992) that extensive practice is a prerequisite to teaching expertise.

More than half of the participants had doctoral degrees and other 37.6% completed master's programs. Only three had not started graduate schooling, one of whom was a certified public accountant.

That 88.3% of the participants had at least a master's degree is a significant finding, considering that only a small percentage of college teachers in the Philippines have graduate degrees. Gonzalez (1992) wrote, "Our so-called college faculty are not qualified… only 25% have graduate degrees and teach at a level that does not go beyond secondary school when we judge them by international standards" (p. 2). As a whole therefore the participant expert teachers are an exceptional group. More important, the finding implies that graduate education is one factor that can possibly explain teaching expertise in Philippine higher education.

More the one-third of the participants completed graduate programs either in education, educational administration, educational technology, or technician education (36%). The rest were either master's or doctoral degrees holders in applied and natural sciences (15%); nursing, public health, or medicine (6%); political and social science, or economics (6%); psychology, guidance or counseling (5%); philosophy (3%); and agriculture (3%).

Aside from education most of those graduate programs have a teaching component. Fifty-five or 80% of the participants either completed or were enrolled in those programs are likely to benefit students who are engaged in teaching because of the opportunities for sharing research and work experiences in the field. This could be one precursor of excellent teaching, especially among the expert teachers who did not undergo a formal training in teaching at the undergraduate level.

About 61.7% of the experts espoused progressive philosophies, compared with 19.6% who were traditionalists. The rest were eclectics. In general, they were inclined to view the teacher as guide or facilitator of learning; the students as active participants in the teaching-learning process, and education as a means of developing the learners holistically and of improving society.

Most of the participants (78.3%) were mixed-brained. This explains their flexibility in the use of analytical and global teaching techniques and facility in catering to different learning styles of their students. The rest were left-brained. Most of the left-brained expert teachers were in the fields of science, mathematics, language, literature, philosophy, research, nursing, and agriculture. The left-brained expert teachers generally preferred strategies that required

inductive analysis, critical thinking, and logical reasoning. This is because left-brained individuals process information analytically, logically, and sequentially. They pay attention to details and specific information from which deductions can be made.

When viewed in relation to educational philosophy, the left-brained teachers generally seemed to be more inclined towards the more traditional and structured philosophy, Perennialism. In contrast, the mixed-brained teachers, as a whole, espoused the more progressive and less structured, Experimentalism. Furthermore, there were more Eclectics among the mixed-brained participants than among those who were left-brained. These findings imply the possible existence of a relationship between brain dominance and educational philosophy. However, statistical analysis made in the present study failed to establish this relationship, which may be partially attributed to the relatively homogenous composition of the participants as regards the variables of interest.

Factors Contributory to Teaching Expertise

The majority of the respondents attributed their success to their love and concern for the youth, patience, perseverance, and being understanding: perceptions which were verified in the videotape lessons. They also attribute their success in teaching to encouraging and supportive school administrators (69.6%), engagement in professional activities (53.6%); favorable work environments with provisions for reasonable workloads, faculty development, collegial interactions, and release of creativity (52.2%), and supportive family members (44.9%) friends, colleagues, and confidantes (26.1%).

Having teacher role models was also cited by 62.3% as contributory to their success in teaching. It is interesting to note that a big percentage of the expert teachers had as their role models, former mentors at the tertiary level. This finding highlights the importance of exposing prospective teachers to excellent teaching during their undergraduate years.

Base on the results of content analysis of the videotaped lessons and classroom ethnographies of the expert teachers, expert teaching in Philippine higher education has two components or dimensions: effective teaching and responsible teaching. Expert teaching refers to instructional practices and behaviors aimed at the attainment of educational objectives that promote academic achievement (effective teaching) and the development of desirable attitudes and values among the students (responsible teaching). In the absence of either effective or responsible teaching, there can be no expert teaching. Expert teaching is concerned with the holistic development of the learner.

Sub-domains of Teaching Expertise

Expert teaching is comprised of six sub-domains. Briefly, these broad, generic dimensions of expertise are as follows:

Subject matter expertise. This refers to a through mastery of course content and knowledge of how best to organize such content to facilitate learning. It includes knowledge of recent developments in the field, of the relationship between course content and allied or related disciplines, and of clear, practical and interesting examples and applications that facilitate learning.

The expert teachers covered by the study give lectures without reading notes, and answer students' questions knowingly and convincingly. Their expertise in their field gives them a high level of self-confidence, such that they can accept an oversight or error without loss of confidence. They are highly credible to the learners.

They organize course content in a form that makes student see how different ideas, concepts, and principles are meaningfully related. They have on hand concrete, practical, and interesting examples or illustrations that clarify abstract ideas, relate theory with practice or, show applications to life problems.

They can easily relate particular lessons or topics with those in another course/discipline whenever called for. This enables students to view and appreciate the course in relation to other fields. They cite recent development or updated information related to course content, and share what authors (aside from authors of the textbook being used by the class) and other expert say about particular topics covered by the course.

Classroom management expertise. This is characterized by effective and efficient management of class time and efficient management of class time and maintenance of students' on-task behavior relative to the instructional objectives.

In the classrooms of expert teachers, routine activities are done with ease and within the shortest time possible. They see to it that all needed instructional materials and equipment are functional and ready for use before the start of their classes.

They manage their time productively, relative to their instructional plan, and student are made conscious of the value of time, especially during team/group activities. They provide smooth transitions from the previous to the new lesson, and from one class activity to another, so as not to confuse the students.

Students taught by the participant expert teachers do not experience idle moments or boredom that can lead to behavior or discipline problems. Moreover, they are made aware of course requirements, acceptable and unacceptable class behavior, and standards of desired performance. These practices prevent the occurrence of class disruptions.

Instructional expertise. This is descriptive of instructional clarity and teacher's functional knowledge varied instructional methods and strategies.

The expert teachers make learning interesting, easy, and meaningful, through the use of varied teaching strategies; student groupings (i.e., large/whole class, team/group, dyad); and judicious use of appropriate instructional materials and equipment that serve to clarify concepts and facilitate learning.

They demonstrate instructional clarity, the ability to simplify and clearly present learning content in a form that can best be understood by the learners, they see to it that students gain a holistic view of the course, and see the relationships between learning activities and course objectives.

Diagnostic expertise. This refers to the teacher's knowledge of students' abilities, interests, and achievement levels; anticipation or awareness of misconceptions that students' learning difficulties; coupled with skills in responding positively and immediately to such problems.

The teacher experts can identify particular student/s who cannot cope with the lesson, while addressing the whole class. They encourage students, whom they sense are experiencing problems or difficulties, to raise their questions. They check on students' understanding through the latter's nonverbal language (e.g., facial expression), through direct questions intended for that purpose, or through some other means. They can anticipate

learning problems or difficulties, as well as misconceptions that students are likely to have. They provide immediate remediation or clarification in response to identified learning difficulties or misconceptions.

Relation expertise. This refers to a teacher's human relation skills in the classroom that server to encourage student participation and risk-taking in class activities, establish rapport with the class, and enhance students' self-esteem and self-confidence.

Relation expertise enables a teacher to provide a pleasant learning environment characterized by mutual trust and respect. Expert teachers do not make threats, intimidate, ridicule, or embarrass students. Instead, they manifest genuine concern and caring for the students. They call students by their names, which sends the message that they know each student personally and that each one is important. They communicate explicitly or implicitly, their belief in the students' capability to assume responsibility for their own learning. They skillfully use classroom humor to make students feel at ease and enjoy learning. Because Filipinos are by nature warm and friendly as a people, relational expertise comes out strongly as a sub-domain of teaching expertise.

Communication expertise. This refers to the skillful and expressive use of verbal and nonverbal language that arouses and maintains students' interest and attention. Expert teachers observe clarity in giving lectures and instructions, and in framing questions. They provide for two-way communication, characterized by attentive listening, and openness to students' questions and opinions. Their skillful use of language facilitates interactive and participative classroom discussions.

Their oral communication is characterized by good diction, articulation, and fluency of expression; expressiveness and clear language; a pleasant voice quality, and variations in pitch, intonation, volume, and rate of speech that serve to sustain students' attention. They are also skillful in the use of nonverbal language. Their expressive facial expressions, hand and arm gestures, and whole body movement greatly help in driving home a point. They are their best visual aid, whether intentionally or unintentionally.

The Pyramidal Model of Teaching Expertise

The study also revealed core teacher behaviors, practices, and attributes which are common to all the participant expert teachers. As such, all expert teachers may be expected to demonstrate or manifest these "essentials" or requisites; and one who is lacking or deficient in these aspects cannot be considered an expert.

Although all expert teachers can be expected to manifest the essentials of teaching expertise, they vary in the extent with which they demonstrate additional teaching practices, behaviors, and personal attributes that further enhance their teaching performance. Their comfort levels in observing those elements in classroom teaching spell out the subtle yet discernible differences in their "levels" of expertise. These differences have corresponding observable effect on the interest, attention, and engagement of the students in the classroom learning activities, and on the teachers' rapport with the class.

The following observations were common to all of the expert teacher: content mastery, instructional clarity, interest and enthusiasm, non-threatening disposition, provision of a psychologically safe learning environment, high rapport with students, efficient handling of routine activities and time management, provision for two-way communication, sensitivity to students' anticipation of probable learning problems or misconceptions, and absence of class disruptions. These were referred to in the emergent model as the core classroom teaching behaviors and practices "essential" to the attainment of teaching excellence.

The Essentials of Teaching Expertise

Content mastery. All expert teachers have a very thorough knowledge of subject matter. They know the most appropriate entry point in introducing a concept, skill, or information, the best sequencing of subject matter, and the breadth and depth of content that can be covered in one class session. They know specifically at what points references to past topics or to related topics in other disciplines or courses should be made to facilitate understanding or, to broaden students' insights/perspectives. They have a low of concrete, practical, and interesting examples and/or applications to clarify abstract ideas, concept or, theories.

Instructional clarity. All of the experts communicate their understanding of content to their students clearly, in the simplest way possible. This instructional clarity facilitates learning and prevents the occurrence of misinterpretations and confusion on the part of the learners. Expert teachers present learning content to the level of understanding of the learners. Their explanations, interpretations, and directions are clear, easy to follow, direct to the point.

Interest and enthusiasm. All expert teachers are interested in what they are teaching, in the teaching act itself, and in interacting with their students. They teach with a contagious enthusiasm that arouses students' interest and attention and prevents boredom from creeping in.

Nonthreatening disposition. All expert teachers project a pleasant, nonthreatening, disposition. They address their students by name, communicate concern, and treat them with respect. These personal attributes help promote a psychologically safe environment where student are not afraid to take risks. Also, expert teachers are non-intimidating and patient, and they do not mind repeating or giving additional examples and explanations, as needed.

Absence of class disruptions. Classes of expert teachers do not experience any disruption during the learning process. Their class activities go on smoothly without delays that can be caused intentionally by bored, disinterested or, misbehaving students.

The Enhancers

Over and above the six essentials or requisites for expert teaching are the "enhancers," which have corresponding observable effect on the interest, attention, and engagement of the students in the classroom learning activities and on the teachers' rapport with the class. Together with the percentages of experts who demonstrate them in their classroom teaching, these enhancers have been identified as: maintenance of students' on-task behavior (91.4%); use of varied instructional strategies (89.9%); excellent oral communication skills (88.4%); expressive body language (88.2%); ability to develop students' responsibility for learning (84.2%); learner-centeredness (84.1%); use of varied instructional equipment and materials (82.6%); magnetism and charisma (76.8%); ability to make learning pleasant and enjoyable (65.2%); values integration (62.3%); affectionate interactions with students (60.9%); and sense of humor (39.1%).

Maintenance of students' on-task behavior. The expert teachers keep their student highly participative and attentive during lectures and class discussions, and serious and quiet during seatwork activities or experiments.

Use of varied teaching strategies. Although an expert teacher can sustain students' interest and attention through an interesting and meaningful lecture or through a well-

conducted lecture-recitation, the use of varied teaching strategies tends to engage students more actively in the learning process. A teacher does not have to use a variety of teaching methods and strategies to be an expert, but doing so can further enhance teaching expertise.

Excellent oral communications skills. All expert teachers express themselves clearly, but some do so more expertly than the rest. The former are highly articulate, fluent, and concise. They have good voice quality (pleasant, well-modulated, clear). They vary their tempo or rate of speech, intonation, and voice volume to stress important points during their oral presentations. Their facility and expressiveness in oral communication help arouse and sustain students' attention. They have gift of language, and their students appear to admire them for this.

Expressive body language. The expert teachers are very expressive in driving home a point through their voice, facial expressions, arm gestures, and whole body movement.

Ability to develop students' responsibility for learning. Expert teachers express, either explicitly or implicitly, their belief in the learners' capability to learn. Although they assume the primary responsibility to effect learning through well-planned and well-organized learning activities, they purposely and judiciously shift to the learners, the responsibility for the learning process. They are also good listeners and are sensitive to students' learning difficulties or problems.

Learners-centeredness. Although a teacher can attain teaching expertise with use of teacher-centered and subject-centered instructional methods and strategies, it helps to be learner-centered in teaching. Some expert teachers prefer teaching strategies that actively engage students in the learning process. They refrain from spoon feeding students with information. Rather, they employ learner-centered methods and strategies most of which involve group or cooperative learning that provides opportunities for the development of personal and group discoveries and insights. They judiciously employ teaching strategies in consideration of the ability and maturity levels, need, and interests of learners. They use their skills in questioning and in providing illustrations, examples or at most, prompts to guide students in coming up with a generalization, rule, or conclusion by themselves.

Use of varied instructional equipment materials. It would suffice for an expert teacher to solely use the chalkboard as an instructional material. However, some experts use additional instructional equipment and materials to clarify concepts, enrich or strengthen their lecture, stimulate thinking, motivate student participation and application of learned concepts, or test students' understanding. These practices further enhance teaching expertise.

Magnetism/charisma. This is not essential, but is contributory to teaching expertise. Some expert teachers exude a certain magnetism or charisma which is much stronger than any stimulus that mat distract students' attention. They are very articulate and expressive in driving home a point gestures, voice inflection, and body movements. They are their best "audio-visual aids". The manner with which they deliver an input lecture or explain something; pose a question and wait for an answer; respond to a students' answer or query; carry themselves, speak, move, and use body language to communicate, all make the difference. They are spontaneous; they exude charm. Without any deliberate or conscious effort, they keep students interested and fascinated, and perhaps mesmerized, but definitely attentive and highly participative. They attract students' attention and sustain interest, just by being themselves.

Knack for making learning pleasant and enjoyable. Some expert teachers conduct their classes seriously, albeit in a non-threatening manner. However, other experts go one step further to make learning pleasant and enjoyable instead of being dour and boring. Their happy

disposition and well-planned, interesting, exciting learner-centered activities bring about this learning situation. In their classes, students learn and "play" at the same time.

Values integration. The integration of values in the lessons is another practice that further enhances teaching expertise. Some experts introduce values in their lessons either as planned (e.g., deducing values from the lesson) or unplanned (i.e., when the opportunity presents itself). These teachers are as much concerned with the affective as with the intellectual growth and development of their student.

Affectionate interaction with students. Some experts treat students as "unique individuals" instead of "numbers" that comprise a class. They give each student a feeling importance, of being appreciated. These teachers are able to communicate such attention and interest without effort, and unintentionally. It appears to be something natural to them, a part of their person. They call students by their names, prod them when needed, smile at or assure them when they are ensure of themselves or of their answers. They are caring and concerned, providing immediate help to those who experience learning difficulties. They teach with a "personal touch."

Classroom humor. Some expert teachers have a strong sense of classroom humor. They have the knack for injecting pun, jokes, or funny remarks, but always, in relation to the lesson. Their classroom humor eases the tension or pressure on students caused by complex or difficult lessons. They make learning not only pleasant and enjoyable; they make it fun.

In view of the decrease in the percentages of experts who manifested the enhancers in their classroom teaching, a schematic presentation of the resulting model takes the form of a pyramid, with the base representing those common to all of the experts and the apex, those which occurred the least. However, the pyramid is not suggestive of any hierarchical interpretation; rather, it merely serves to delineate practices, behaviors, and attributes which are essential, from those that further enhance, or are contributory to, expert teaching. A combination of the essentials and of the enhancers spells out the ultimate in teaching expertise in tertiary education in the country.

Although the study was conducted at the tertiary level, the emergent model of teaching expertise yielded classrooms practices and behavior that are applicable to other curriculum levels. Following are the implications of the findings of the study, particularly of the derived model of teaching expertise, for teacher preparation, testing, and development, and for decisions concerning faculty promotion, merit pay, retention, and tenure.

Teacher preparation. That the majority of the teacher experts were not products of teacher-training institutions implies that such institutions do not necessarily have an edge over other HEIs in terms of preparing graduates for a successful teaching career. This points to the need to improve the curricular and instructional programs of teacher-training institutions.

The study indicates that oral communication skills and expressive body language greatly contribute to teaching expertise, along with dynamism, charisma and magnetism. In view of this, teacher education programs should include a required course in acting and expressive communication. The course should provide training in emphatic oral delivery (i.e., voice projection, use of pauses for emphasis, vocal variation in pitch, tempo, and volume) meaningful facial expressions, gestures, and movement.

Prospective teachers should be influent in the medium of instruction and should be lively, enthusiastic, and dynamic. Boring, colorless teachers who speak in monotones cannot arouse, much more sustain students' interest and attention. A teacher should be his or her best audio-visual aid.

Teacher education programs should provide lessons that will enable prospective teachers to clarify a personal educational philosophy that will later serve to focus their future educational efforts as practitioners. Hand in hand with provisions for intellectual growth, education students should have as many opportunities as possible for value clarification. Due emphasis should be given to their spiritual and moral development so that they can become role models for their future students.

Most of the expert teachers in the study are mixed-brained who are adept in the use of both left-brained (analytical) and right-brained (global) techniques of teaching. In this light, curriculum programs should provide training on brain integration and include lessons on creativity in the curriculum. More important, students should be encouraged to be imaginative and to employ different teaching techniques and instructional materials during their practicum. Thus, even if they are left-brained, they will be familiar with the use of different strategies and audio-visual stimuli in teaching.

In addition, any effort to revise the curricular program for teacher education students should consider the manifestations of expert teaching as inputs. Mere acknowledge and understanding of what makes for expert teaching will not be enough. Theoretical and conceptual knowledge should be accompanied by actual applications, especially during internship or practice teaching.

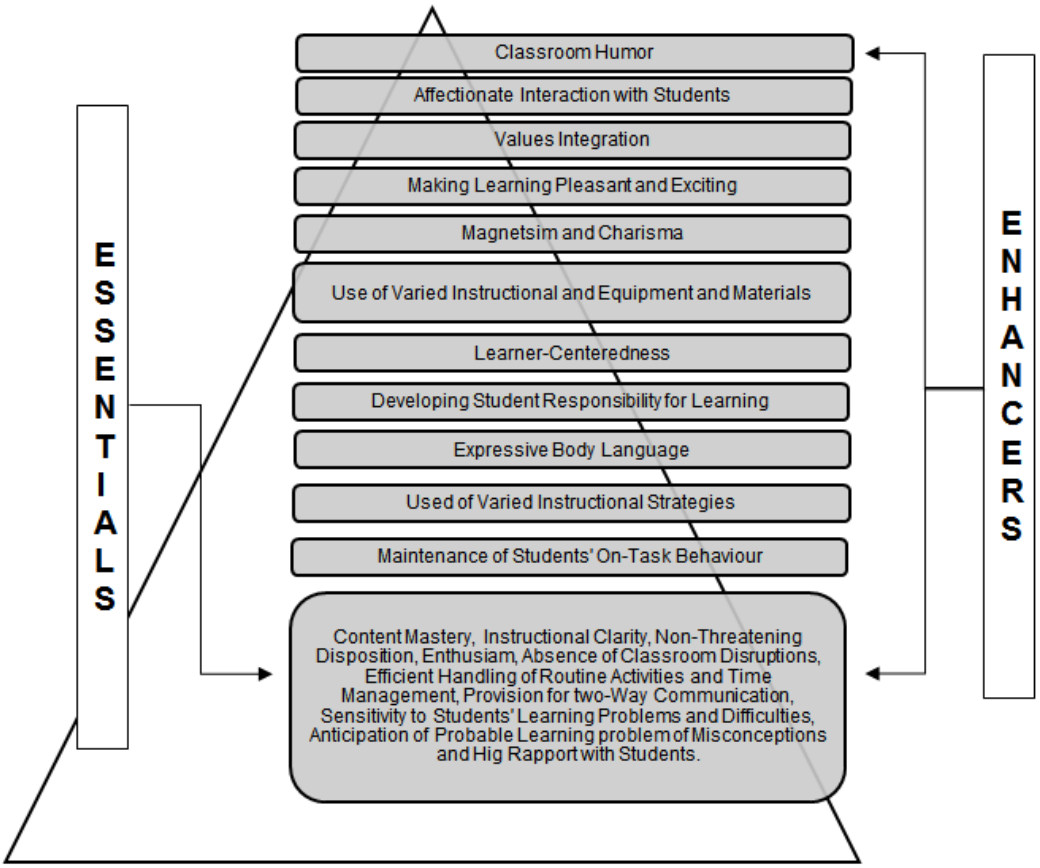

Figure 2. A Pyramid Model of Teaching Expertise in Philippine Higher Education

The study shows the long-lasting influence of exemplary teacher role models on novice teachers; hence, education students should be exposed to the best teachers. Ineffective teachers who have lost their zest and commitment for teaching have no place in teacher-training institutions.

Responsible learning should be exacted from the students. Teachers should refrain from giving straight lectures entirely lifted form textbooks and from employing spoon-feeding techniques that suppress students' self-expression, exploration, independent thinking, creativity, and discovery. Instead, extensive opportunities for independent learning should be provided, because such is the demand of the teaching profession. Education students should also have an interest in professional readings and a passion for continuous learning. Professional readings should be part of course requirements, especially in foundation and major courses.

Teacher testing. Professional board examinations for teacher should be review and improved in the light of the emerging model of teaching expertise. Professional board examinations for teachers should be competency-based, grounded on empirical research on teaching expertise. Such tests can include semi-projective test items in the form of sentence completion items wherein possible responses could be anticipated, coded, and weighted. The test may also include critical-incident items that can assess the soundness or appropriateness of examinees' choices, when confronted with hypothetical situational classrooms problems or dilemmas based on actual cases. Also, possibilities of adopting additional or alternative authentic evaluation techniques such as performance-based and portfolio assessments (which will include, among others, videotapes and formal classroom observations by critic/supervising teachers of the examinees' classroom teaching) should be explored.

Teacher development. Teacher development programs should consider the Model on conducting a faculty needs assessment and in designing a faculty development program tailor-suited to identified needs. In addition, classroom observation guides should be reviewed in the light of the findings on teaching expertise. Subsequently, post-observation conferences should focus on item that contribute to effective and responsible teaching.

Expert teachers should be encouraged to write memoirs of their teaching career, particularly of their problems as beginning teachers, and of how they overcame stumbling blocks. Making such professional reading material and videotaped lessons of expert teachers readily accessible to the faculty may help inspire future teachers.

A scheme to share expert teachers under an expert-teachers exchange program may be put in place. Expert teachers may be invited to give lectures and demonstration lessons to faculty, and may also be tapped as instructional supervisors, or mentors of new teachers. Their presence and their services will be very helpful especially to new teachers and to those who are experiencing difficulty or, have lost their zest, in teaching.

Decisions concerning faculty promotion, merit pay, retention, and tenure. HEIs are continually in the process of developing or improving tools that can guide teacher selection, merit pay, promotion, retention. For screening teacher applicants, an interview guide patterned after the model of teaching expertise developed in the study may be used. The data-gathering instruments used in the study (brain test, educational philosophy assessment form, applicable portions of the questionnaire for expert teachers) may be employed to identify applicants whose educational philosophy, brain dominance, and personal and professional profile meet or come closest to the expectations of the school. The teaching practices and behaviors characteristics of expert teaching should be factored in making decisions concerning faculty promotion, merit

pay, retention, and permanency. For this purpose, an evaluation instrument anchored on the proposed model should be developed.

Expert teachers can be role models and a source of inspiration for their students and colleagues. Hence, they should not be pulled out from teaching to assume full-time administrative positions. Moreover, considering that they are valuable human resources of educational institutions, their services should be extended, past retirement age, so long as they are willing, and their health so permits.

Future research. The study does not make any pretentious claim about the generalizability of the model. As is always the case in theory-building research, a theory or model should be tested or verified, through replications across time and geographical settings. Thus, there is a need to verify the model of expertise proposed study. For this purpose, replications may be conducted at other curriculum levels and in other geographical settings. Similarities in findings can expand the external validity of the present model, while differences can delineate aspects of teaching expertise specific to particular curriculum level and contexts. Both will extend the literature on expert teaching in Philippine schools.

Model building is relatively an unpopular research option especially among educational researchers. Hence, the present study may inspire replications and related studies among teacher experts in other settings, thereby contributing to the limited empirical literature in this field. Furthermore, in the words of Shulman (1992, p. 14), "Teaching is and has always been at the center of all education and educational reform" thus, any research that focuses on teaching is significant, especially if it provides an empirical base that can guide policy actions concerning teachers.

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SELECTED ATTRIBUTES OF MOBILE PHONE: BASIS FOR BUYING PREFERENCE OF EMPLOYEES IN THE BPO INDUSTRIES

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Estrellita S. Glodo

INTRODUCTION

Mobile communication has been viewed as one of the fastest growing industries for the future of world economy. As such, mobile phone industry has been one of those bright spots in Asian economy during the last decade, and just in China, the mobile phone market has been increasing at a rate of 80 percent since 1990 and became a market of 130 million users in 2001 – exceeding US for the first time (Robertson, 2001), and over 335 million by 2004. Along the increase of mobile communication and mobile phone usage worldwide, the competition for global mobile phone market has been extremely intensified. For instance, in current China's mobile phone market, there are more than 600 mobile phone models on sale by over 110 mobile phone manufacturers (Motsay, 2004), including both domestic and international mobile phone producers competing with a variety of different marketing strategies and competitive advantages. For example, some companies are competing by promoting its high tech features while others competing through so-called „star power" with celebrity endorsement to their products. Not unusual, there are also companies competing with unique aesthetical features such as: attractive appearance, dialing speed, color, and the possibility of customization.

Those marketing strategies have been widely used in many different industries based on the related market analysis about consumers purchasing behavior, especially, the influence of these so-called social influence groups. Historically, a mobile phone has been pricey with the market dominated by business users (Kendall, 1997). It was considered a status symbol for the rich and famous during the early 1990s all over the world. In China, people could remember. The scenario where mobile phone owners talked anywhere and with pride sending a message that the ownership of a mobile phone represented power, prestige, and success. In contrast, American mobile phone consumers used to believe that when they sign up with a mobile phone service, a free phone was included. At that time, it was the ownership of a mobile phone, not its technology or its appearance, that distinguished the owner from others. It was predicted in 1994 that the demand for mobile communication would make a continuing growth of US mobile phone market and reaching a penetration of 50 percent in 2005 (Scouras, 1995). The real market growth was in fact better than the expected with 74 percent of Americans who used mobile phones in 2003 (Palenchar, 2004). More recently, mobile phones have become common not only in all urban areas but also in smaller towns and remote rural farms. Following these changes in trends, one can easily find many advanced emerging generations of mobile phones, smaller, lighter, better designed, multi-functional, and with a much affordable price. (Robertson, 2001).

THEORETICAL FRAMEWORK

The Theory of Planned Behavior

This investigative study is anchored on the theory of planned behaviour by Ajzen, the theory is found to be well supported by empirical evidence. Intentions to perform behaviors of different kinds can be predicted with high accuracy from attitudes toward the behavior, subjective norms, and perceived behavioral control; and these intentions, together with

perceptions of behavioral control, account for considerable variance in actual behavior. Finally, inclusion of past behavior in the prediction equation is shown to provide a means of testing the theory's sufficiency, another issue that remains unresolved. The limited available evidence concerning this question shows that the theory is predicting behavior quite well in comparison to the ceiling imposed by behavioral reliability.

CONCEPTUAL FRAMEWORK

The conceptual model which will be the guide in this study follows the System Approach Model utilizing the INPUT, PROCESS and OUTPUT model which is shown in figure 1.

INPUT	PROCESS	OUTPUT
Respondents Profile • AGE • GENDER • CIVIL STATUS **ASPECTS** ➢ PRICE ➢ SOCIAL GROUP ➢ BRAND ➢ PRODUCT FEATURES ➢ QUALITY ➢ SALES SERVICE	• SURVEY QUESTIONNAIRE • Analysis and INTERPRETATION OF FINDINGS • STATISTICAL TREATMENT	• GOOD QUALITY ATTRIBUTES OF MOBILE PHONE BRANDS.

FIGURE 1. RESEARCH PARADIGM

STATEMENT OF THE PROBLEM

This study aimed to identify what selected attributes in purchasing mobile phone brand are acceptable criteria in thee determination of the buying preference of mobile phones by the employees.

This research sought to answer the following questions:

1. What is the profile of the respondent in terms of:

    1.1 Age;
    1.2 Gender; and
    1.3 Civil Status?

2. How do the respondents perceive the selected attributes of mobile phone that influence the buying preference of the employees:

    2.1 Price;
    2.2 Social Group;
    2.3 Brand;

2.4 Product Features;
2.5 Quality; and
2.6 Sales Service?

3. Is there significant difference with regards to the six preferred attributes in the purchase of mobile phones by the employees?

HYPOTHESIS

There is no significant difference with regards to the six preferred attributes in the purchase of mobile phones as perceived by the two groups of respondents in the aforementioned variables:

SCOPE AND LIMITATION

The setting/venue of the study is only limited to the employees in BPO industries, it concentrates and focuses on the selected attributes of mobile phone and the buying preference of employees.

The study covered year 2016-2017.

SIGNIFICANCE OF THE STUDY

The researcher believe that the findings of this study will be important and beneficial to the following:

Suppliers/Manufacturers

Suppliers and Manufacturers will be informed and keep abreast in understanding the acceptable criteria or preference of the employees in buying their own mobile phone brand encouraging them to a lot more time in research to update their technological knowledge and skills to be able to come up with the product that will suit the demand of the buying public.

Consumers

Consumers will be guided and equip themselves with the latest trends of functional features of the mobile phone they would prefer to buy and use for practical purpose.

Future Researchers

Researchers will be inspired more to continue on their work to improved their product and look for a more better way to be able to come up with a multi-functional but practical product that will supply the demand of the labor market.

DEFINITION OF TERMS

The following terms are conceptually and operationally defined to establish common reference between the researchers and the readers for better understanding:

Behavior refers to the act or manner how a buyer or consumer thinks or feel when purchasing a product.

Consumer refers to a person who buys mobile phone or its services to their own use.

Mobile Phone Manufacturer refers to a company that produces mobile phones in large numbers.

Market refers to an area that where a product or a service can be sold.

Star Power refers to an strategy that companies use by using a celebrity to endorse their product.

Survey refers to an examination of opinions made by asking respondents to answer questions through a questionnaire given to them.

Price refers to the quantity of payment or compensation given by party to another in return for goods or services.

Social Group refers to a collection of people who interact with each other and share similar characteristics and a sense of duty.

Local Literature

Mobile phones are one of the most conspicuous examples achieving a large penetration rate in many markets (Kimiloglu & Nasir, 2010). Its growing and evolving development to connect to people in different ways has enabled it to become more than just a communication device (Walsh, White, Cox, & Young, 2011), and this phenomenon is very much observable in the Philippines. The Philippines is home to a significantly huge telecommunications market (Donner, 2008; "Globe Telecom, Inc. Annual Report," 2011; "Philippine Long Distance Telephone, Co. Annual Report," 2011;"Telecoms industry report: Philippines," 2010). Statistics show that the information and communications technology (ICT) market in the country is estimated at US$2.8billion in 2009 (1.7% of GDP). The number of mobile phone subscribers is estimated at 77 million in 2009, doubling from 34 million in 2005. Marketresearch.com further estimated that subscribers would increase to 115 million by 2016 from 87 million in 2010. It is expected that 91.5% of the total population of the Philippines owned a mobile phone in 2011, up from 60% in 2005. The Philippines has been dubbed as the “texting capital of the world” because of the massive daily volume of its text (short message services or SMS) transmissions by high- and low-income groups alike (Celdran, 2002; Lallana, 2004; Librero, Ramos, Ranga, Triñona, & Lambert, 2007; Pertierra, 2005). This reflects the significant acceptance of the Philippine market towards mobile phones. However, there are still emerging technologies that are not fully grasped by the country’s market (Gerpott, 2010; Librero et al., 2007;"Telecoms industry report: Philippines," 2010). Advanced functions such as face-to-face interaction available on multimedia (MMS), 3rd-Generation (3G) mobile phones are still relatively rare in Asia (Donner, 2008; Kimiloglu & Nasir, 2010; Liao, Tsou, & Huang, 2007), which can be difficult for consumers to grasp because they have never experienced it. Marketresearch.com further stated that 3G subscribers in the country only account for 12.2% of the market. Philippine Long Distance Telephone Company (PLDT), through its mobile provider Smart Communications, and Globe Telecoms, the Philippines’ biggest telecommunications, have recently introduced such technologies that allow users to download music and video, to send and to receive e-mail, and enable Worldwide Interoperability for Microwave Access, or WiMAX (Kimiloglu & Nasir, 2010; "Telecoms industry report: Philippines," 2010). As of 2011, Smart Communications reported a cellular subscriber base of 63.7 million ("Philippine Long

Distance Telephone, Co. Annual Report," 2011) while Globe Telecoms reported 30 million subscribers ("Globe Telecom, Inc. Annual Report," 2011). Hence, it will not be long before subscribers will acknowledge that mobile phones will become a part of everyday lives, both in the business setting and at home (Liao et al., 2007; Mort & Drennan, 2007; Walsh et al., 2011). However, despite advances in marketing and advertising, companies still tend to deploy traditional methods and techniques to push their products and services to the market. Furthermore, as previously mentioned, these growing mobile technologies are still in their infancy stages in the Philippines. These observations imply that the knowledge regarding these growing technologies have not yet entered mainstream consumer mindsets. This gives an opportunity for this research to shed further light on possible consumer behaviors and insights regarding mobile phone technologies for the benefit of both marketing researchers and practitioners.

Foreign Literature

Kotler and Armstrong (2010), Consumer buying behavior refers to the buying behavior of the individuals and households who buy goods and services for personal consumption. Consumers around the world are different in various factors such as age, income, education level and preferences which may affect the way they avail of goods and services. This behavior then impacts how products and services are presented to the different consumer markets. There are many components which influence consumer behavior namely; cultural, social, personal and psychological (kotler and Armstrong, 2001). Consumer behavior is the study of when, why, how and where people do or do not buy products (Sandhusen, Richard L; 2000). Kundi J. et al (2008) Stated that consumer behavior refers to the mental and emotional process and the observable behavior of consumers during searching, purchasing and post consumption of a product or services. Consumer behavior blends the elements from psychology, sociology, sociopsychology, anthropology and economics. Mobile phone choice and use has also been found to be related to prior consumption styles. According to a fresh survey of Finnish young people aged 16-20, it was found that mobile phone choice and especially usage is consistent with respondents" general consumption styles (Wilska, 2003). The research showed that addictive use was common among females and was related to trendy and impulsive consumption styles. Instead, males were found to have more technology enthusiasm and trend-consciousness. These attributes were then linked to impulsive consumption. The study concluded that genders are becoming more alike in mobile phone choice. Because individual differences in consumption patterns are obviously identifiable, we assume that background variables especially have an influence on mobile phone choice. Men and women purchase and relate products for different reasons (Dittmaret al, 1996). They are subjected to different social pressures (Darley and Smith, 1995). Male and female have a propensity to be right and left hemisphere reliant respectively (Meyers-Levy, 1994). Males are generally self-focused while females are responsive to the needs of both self and others (Meyers-Levy, 1988). Coley and Burgess (2003), in their empirical study on wide range of products such as clothing, consumer electronics and books etc. had found significant differences between men and women with respect to both affective and cognitive process components. Rochaet al(2005) had also experienced different requirements for clothing and fashion products based upon age and gender. Larocheet al(2000) had found gender differences in relation to acquisition of in-store information for buying Christmas clothing gifts. Vankatesh and Morris (2000) studied the moderating role of gender in the adoption of a new software system. They revealed that the determinants of adoption vary between genders; perceived usefulness of the technology was the major factor considered by men for the acceptance of new software. In contrast, the perceived ease of use of the software and the normative influence (for instance, influence of peers and superior perception) were found key determinants for women. Ease of use and normative influence had not been found significant

for men. Men consider the most prominent sign; they are more likely to focus on task effectiveness of a technology without considering risk. In contrast, women are detailed processors and consider all information available including the ones that are understated and potentially disconfirming. Women are then more likely to incorporate risk and other secondary information in their decisions and behavior (Grahamet al,2002). Williams (2002) investigated the effect of social class, income and gender effects on the buying perceptions, attitudes and behavior. The products like dress clothing, garden tools, automobiles, wedding gifts, living room furniture, children's play clothing, kitchen appliances, casual clothing and stereos were selected that varied in durability, necessity, expressiveness and gender orientation. The study emphasized on understanding the evaluation criteria, which correspond to product attributes and the benefits expected by the consumers. Both men and women rated utilitarian criterion high over the subjective criterion. Women attached importance to all criteria across all products, while men gave importance to only price. However Goldsmith (2002) found consistency for both men and women while examining personal characteristics of frequent clothing buyers.

Local Studies

A market study conducted by TNS a global customized research company conducted from November 2012 to January 2013 consisting of 38,000 respondents in Metro Manila, 75% of the respondents surveyed used mobile phones to take photos or videos; 45% to browse the internet; 44% to access social networking sites; and 37%.The findings of the study states that Filipino consumers changed their perspective from buying phones based on physical features in choosing a phone that their personal experience will be enhanced. It also found out that a typical household owns at least four of the following devices; a mobile phone (89%), smart phone (53%), tablet (14%), desktop (39%),laptops/netbooks (37%), and smart tv (4%). (By Philstar Philippines, July 2, 2012).

A marketing research study conducted by Berico et al. (2008) showed that the preference towards features of mobile phones by consumers is high with a grand mean of 4.85. Among the features mentioned are high quality built-in camera lenses, music player and web connections, these are some of the most advanced features offered by mobile phone makers during those times. The study also showed that consumers preferred mobile phones which are very portable and comfortable. This is evident on the handsets that the market have today. Observations revealed that as the variety of mobile phones emerged the growing popularity of the local brands such as Cherry Mobile and Myphone has also captured Manilenio's liking for their preference of mobile brand.

Foreign Study

Based on the study of Malasi, J. M. (2013), it is important for companies to understand how buyers go about choosing between alternatives. As cited Palmer (2000) that also states that a product is any tangible and intangible item that satisfies a need. Consumers do not buy product as an end in them. They buy products for the benefits which they provide. Products therefore comprise of complex bundles of attributes which must be translated into benefits for customers. The main challenge facing marketers today is how to influence the purchase behavior of consumers in favor of the product, service, and experiences which they offer. (Malasi,J. M. 2013). Product attributes are the important tools in convincing the customers to purchase. Asuamah,et al (2013)as cited by Gwin et al(2003) states that product attributes are explained as the features that an object may or may not possess which can be intrinsic and extrinsic. These attributes might bring positive outcome to the person in possession of the product. The possession of a product in addition to its features creates satisfaction to the

consumer. (Jandghi & Hashemi, 2010). Agreed by the study of Khan,S. & Rohj,S. (2013) which the author cited (Das,2012) that stated the intense competition in terms of product similarity and increased number of competing brands in the market have led the marketers to consider and study the factors that are influential in consumers' brand choice decisions and behaviors. The mobile device market has widened to a global scale and consequently mobile devices are distributed throughout the world (Kim and Lee 2005). As the use of mobile phones pervades the world, the globalization of mobile device user interface design is becoming more crucial to business success and building a loyal customer base. Communications technologies are entirely dependent on a social network for adoption and use, and therefore the diffusion of these technologies within a culture should be studied (Urbaczewski, Wells et. al. 2002). The context of the mobile user includes user culture and the influence of culture on mobile phone use (Urbaczewski, Wells et al. 2002; Teo and Pok 2003a; Jones and Marsden 2005). This necessitates a review of culture as an essential part of understanding users and the factors that influence mobile phone usage. The word „culture" originally stems from an agricultural root: „culture as cultivation of the soil and plants" (Hartley 2002). Applying this to people offers a metaphor for the cultivation of products, minds and social relations. There are various definitions of the term „culture". Culture can be seen as the social production of sense, meaning and awareness (O'Sullivan, Hartley et al. 1994). Culture can also be seen as learned behavior consisting of thoughts, feelings and actions (Del Gado 1996), while Hall (1990) describes culture as communication through words, material things and behavior. Honold (2000) argues that it is more meaningful to find a definition of culture that suits the specific area of research than to produce a general definition. Ford (2005) defines culture in the context of HCI as „the patterns of thinking, feeling, and acting that influence the way in which people communicate among themselves and with computers". This definition is also applicable to mobile interaction and we consequently adapted it for the purpose of this study to consider culture as „the patterns of thinking, feeling, and acting that influence the way in which people communicate among themselves and use mobile devices". According to Palen et al. (2000), deployment of mobile telephony varies noticeably internationally and even among western countries. In general, usability studies aim to make technology more useful. Cultural usability goes further and aims to make technology fit in with the user's lifestyle (Sun 2004). In order to be effective, designers 12 therefore have to understand and be aware of the cultural priorities and the value system of users, for instance, they must identify factors that are relevant and sensitive to cultural differences. Fitzgerald (2004)presents four models used for managing cross-cultural software: Cultural dimensions, measuring different cultures according to a number of cultural variables or factors (Marcus and Gould, 2000); Cultural markers, using cultural dimensions in measuring interface design elements that are prevalent and possibly preferred within a particular cultural group (Badre, 2002); Cultural behaviors, measuring on-line behavior of web site users in terms of a four-factor model (Fitzgerald, 2004); Activity theory, viewing people's activities as an object-oriented and tool mediated process in which actions are mediated through the use of artefacts (including tools and languages) to achieve a transformative objective (Sun 2004). Closer to the field of research, Baumgartner (2003) researched the importance of cultural dimensions in the field of user-interface design. The following five dimensions were ranked most important: Context, as described by Hall (1959; 1976); Technological development, referring to the rate of technological development, and scaling from advanced to backward.

Uncertainty avoidance as described by Hofstede (1995); Time perception as described by Hall (1959; 1976); Authority conception or power distance according to Hofstede (1995); race, income, disabilities, mobility (in terms of travel time to work or number of vehicles available), educational attainment, home ownership, employment status, and even location In the context of mobile phone design and usage existing research into the effects of culture has been aimed at the culture-based preferences for specific design attributes (Choi, Lee et al. 2005; Kim and Lee 2005) and the distinction between universal and to- be-localised

components (Lee, Ryu et al. 2005b). The following studies represent the general trends, all using Hofstede‟s premises: Choi et al. (2005a) looked at cultural influences on functionality design of mobile data services by comparing 24 Korean, Japanese and Finnish users. They found 52 attributes considered important by mobile data service users and identified 11 critical attributes related to the user interfaces of mobile data services devices. The critical attributes such as minimal keystrokes, iconic menu style, logica ordering of menu items, variety of fonts and font colours, etc.,clear correlation with characteristics of the culture of the user's country (as identified by 13 Hofstede); Kim & Lee (2005) investigated cultural influence and mobile interface design to clarify the relationship between cultural traits and mobile phone interfaces. Their subjects came from the USA and Korea. The results suggest van Biljon J., Kotze P.: Cultural Factors in a Mobile Phone Adoption. 2655 a possibility of cultural impact on icon recognition. They found that Korean subjects performed better using concrete representations, while American users preferred the abstract icon representations; Lee et al. (2005b) studied multi-cultural usability in mobile phone navigation in a laboratory- based usability experiment with participants from the USA, West Africa, Eastern Europe and South America. They collected cross-cultural usability information in the product development process to determine universal and to-be-localized components, detect mistakes that lead to critical miscommunication, and assess the usability of cross-cultural user interfaces. Their study was again based on Hofstede's premise, but combined with the work of Jordan (1998) on pleasurable products. They found no real differences between the various cultures for the issue of supportiveness, but found evidence that the perception of the same icons differs across cultures. Based on the findings of these studies it can be argued that culture and mobile phones have been researched to some extent, but what we found lacking is a model to integrate the findings on culture with the other factors that influence mobile phone adoption and usage. In order to propose such a model it is necessary to clarify the relationship between the social and the cultural aspects of mobile phone usage. Socially the emphasis seems to be on finding new ways to use mobile phones in enhancing socialisation (Jones and Marsden 2005; Schiphorst 2006) and the use of mobile phones to eliminate physical location as a determinant of communication (Geser 2004). For the purpose of this study, culture is seen as a specific manifestation of social behavior. Social influence will therefore encompass cultural influence.

SYNTHESIS OF RELATED LITERATURE AND STUDY

The aformentioned conceptual and research literature on Selected Attributes of Mobile Phone Brand Basis for Buying Preference of employees in the BPO industries has provided the researcher with rich background in the process of research.

The above cited literature and studies are relevant to the present study. Most of the literature emphasized by our foreign authors like kimiglolu and Nasnir (2010), Walsh, White, Cox and Young (2011), Liao, Tsou and Huang (2007) believed that the growing and evolving development to connect people in different ways has enable it to become more than just a communication device and relatively rare in Asia.

These above mentioned literature are supportive instruments in conceptualizing and enriching this study. Moreover the synthesized literature results of related studies, as reviewed by the researcher, were compared and used in analysis and interpretation of the findings of the present study.

RESEARCH DESIGN

The descriptive method of research, employing questionnaire, was used in conducting this study. Copies of the questionnaire were issued to the target respondents to obtain substantial data about the buying preference of employees in relation to the six attributes of mobile phone brand.

POPULATION, SAMPLING, AND RESPONDENTS OF THE STUDY

Purposing sampling techniques was used in this study. The respondents are composed of two groups. The first group are 50 selected employees.

The second group were first-level managers which is also equally represented by the same number of sample, for a total of one hundred (100) respondents.

RESEARCH INSTRUMENTS

The study utilized the following instruments to gather the needed data:

Questionnaire. This study used a researcher made questionnaire to elicit personal information and the needed data on the selected attributes which serves as the basis of determining the acceptable criteria or preference in the purchase of mobile phone by the buyer as assessed by the two groups of respondents.

The questionnaire consisted of two parts:

Part I consists of the demographic profile of the respondents in terms of Age, Gender, Civil Status

Part II elicit responses on the attributes of mobile phone brand that influence the buying preference of the employees.

DATA GATHERING PROCEDURE

The following steps were followed in gathering the data:

1. Permission was sought from the selected respondents.

2. Upon approval, the researchers personally distributed the questionnaire to the respondents for assessments.

3. The questionnaire were retrieved personally by the researchers to insure its safe return with the help of statistician.

STATISTICAL TREATMENT OF DATA

The data gathered were compiled, collated and summarized. The response to each item were categorized based on the specific problems raised.

Te following were utilized on the treatment of the data:

1. Frequency. It is the actual response to a specific item/question in the questionnaire where the respondents ticks his choice.

2. Percentage. This was used as descriptive statistics or something that describes a part of the whole.

3. Weighted Mean. This was used to measure the respondents assessment. Multiplying each value in the group by the appropriate weight factor does it and the product is summed up and divided by the total number of respondents.

Formula:

$$WM = \frac{(f5x5)+(f4x4)+(f3x3)+(f2x2)+(f1x1)}{N}$$

Likert Scale: Fox Par II

Option	Scale	Verbal Interpretation
5	4.20-5.00	Strongly Agree (SA)
4	3.40-4.19	Agree (A)
3	2.60-3.39	Moderately Agree (AM)
2	1.80-2.59	Not Agree (NA)
1	1.00-1.79	Strongly Disagree (SA

Krustal-Wallis H Test

The Kruskal-Wallis H test (sometimes also called the "one-way ANOVA on ranks") is a rank-based nonparametric test that can be used to determine if there are statistically significant differences between two or more groups of an independent variable on a continuous or ordinal dependent variable. It is considered the nonparametric alternative to the one-way ANOVA, and an extension of the Mann-Whitney U test to allow the comparison of more than two independent groups.

PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

Sub-Problem Number 1. What is the respondents profile as to: Age, Gender, Civil Status.

Table 1

Profile of the Respondents as to Age

Age	F	Percentage
21-25	84	84 %
26-29	16	16 %
30-above	0	0 %
TOTAL	**100**	**100 %**

Age profile of the respondent as presented in Table 1 shows that most of the respondents are young ranging from 21-25 representating 84% while those of the age bracket 26-28 is only 16% of the 100 respondents.

Table 2

Profile of the Respondents as to Gender

Gender	F	Percentage
Male	21	21 %
Female	79	79 %
TOTAL	**100**	**100 %**

Gender profile of the respondents as indicated in Table 2 shows that most of the respondents are female 79 or 79% while the male respondents is 21 or 21% of the total respondents of 100.

Table 3

Profile of the Respondents as to Civil Status

Civil Status	F	Percentage
Married	12	12 %
Single	88	88 %
TOTAL	**100**	**100 %**

It appears from Table 3 that there are more of the single employees representing 88% and married employees represent 12% only of the total of 100.

Sub-Problem Number2. How do the respondents perceived the selected attributes of mobile phones that influence the buying preference of employees in terms of:

2.1 Price

Table 4

Assessment of the Respondents as to Price

Price	Weighted Mean	Verbal Interpretation	Rate
1. Special Promo	3.95	Agree	2
2. Coupons for discounts	3.72	Agree	4
3. Affordable Price	4.37	Agree	1
4. Reasonable	3.89	Agree	3
5. Appropriate for the product	3.61	Agree	5
Average	**3.91**	**Agree**	

Table 4 indicates that the price when taken into consideration the five indicators have an average weighted mean of 3.91 rated as agree. Indicator 4 rank 1 with a weighted mean of 4.37; followed by indicator 1 and rank 2 with a weighted mean of 3.95; indicator 4; with a weighted mean of 3.89 rank 3, indicator 2 with a a weighted mean of 3.61 rank as 5, all as acceptable, respectively.

2.2 Social Group

Table 5

Assessment of the Respondents as to Social Group

Social Group	Weighted Mean	Verbal Interpretation	Rate
1. Recommended use by family member	3.70	Agree	1
2. Influence by circle of friends	3.53	Agree	2
3. Trending on social media sites	3.52	Agree	3
4. Influenced by classmates	3.23	Moderately Agree	4
5. Endorse by a popular personality	3.13	ModeratelyAgree	5
Average	**3.42**	**Moderately Agree**	

As shown in Table 5 with a regards to the agreeability on the Social Group attribute of mobile phones, three of the five indicators were rated agree

.

These are the indicators, with weighted mean of 3.70, rank 1, indicator 2 with weighted mean of 3.53 rank 2 and indicator 3 with a weighted mean of 3.23 and 3.13, respectively, were rated moderately agree. Taking the five indicators collectively shows an average mean of 3.42 rated as moderately agree.

2.3 Brand

Table 6

Assessment of the Respondents as to Brand

Brand	Weighted Mean	Verbal Interpretation	Rate
1. Samsung	4.16	Agree	1
2. Nokia	3.67	Agree	3
3. Iphone	3.85	Agree	2
4. Myphone	3.44	Moderately Agree	4
5. Cherry Mobile	3.18	ModeratelyAgree	5
Average	**3.66**	**Moderately Agree**	

Table 6 represents the various brand of mobile phone in the market. When taken into considerations the five brand indicators, three occupied the top spot. They were indicator 1 with a weighted mean of 4.16 rated as agree followed by indicator 3 with a weighted mean of 3.85 rate as agree and indicator 2 with a weighted of mean of 3.67 also rated as agree and rank 1, 2, 3, respectively. On the other hand, indicator 4 with a weighted mean of 3.44 rank 4 and indicator 5 with a weighted mean of 3.18 rank 5 were both rated as moderately agree. Taking collectively with the five indicators the average weighted mean of 3.66 were all rated as agree.

2.4 Product Features

Table 7

Assessment of the Respondents as to Product Features

Product Features	Weighted Mean	Verbal Interpretation	Rate
1. With Bluetooth, Camera, dual sim, video-recorder, MP3 player, memory card reader and wifi connectivity	4.47	Agree	1
2. Long Battery Life span	4.13	Agree	4
3. Good screen resolution	4.35	Agree	2
4. User Friendly	4.10	Agree	5
5. With complete applications	4.20	Agree	3
Average	**4.25**	**Agree**	

It appears in Table 7 that the five indicators of product features attributes of mobile phones were all rated as agree. Indicator 1 with 4.47 weighted with a mean rank 1 indicator 3 with a weighted mean of 4.35 rank 2, indicator 5 with a weighted mean of 4.20 rank 3, indicator 2, with a weighted mean of 4.13 rank 4 while indicator 4 with a weighted mean of 4.10 rank 5.Taking collectively the five indicators, an average mean of 4.25 was obtained rated as agree.

2.5 Quality

Table 8

Assessment of the Respondents as to Quality

Quality	Weighted Mean	Verbal Interpretation	Rate
1. Virus blocker	4.16	Agree	2
2. Water resistant	4.30	Agree	1
3. Scracth free	4.00	Agree	5
4. Longer life span	4.14	Agree	3
5. Dust and shock resistant	4.02	Agree	4
Average	**4.12**	**Agree**	

As presented in Table 8 the five indicators of quality attributes of mobile phones, that all are rated. Indicator 2 with a weighted mean of 4.30 rank 1, indicator 1 with a weighted mean of 4.16 rank 2, indicator 4 with a weighted mean of 4.14 rank 3, indicator 5 with a weighted mean of 4.02 rank 4, while indicator 3 with a weighted mean of 4.00 rank 5. Taking collectively, the five indicators indicates an average mean of 4.12 rated as agree.

2.6 Sales Service

Table 9

Assessment of the Respondents as to After Sales Service

Indicator	Weighted Mean	Verbal Interpretation	Rate
1. Good customer service provider	4.12	Agree	2
2. Accessible customer service hotline	3.94	Agree	3
3. Accessible customer service outlet	3.90	Agree	5
4. Fast response to complaints	3.92	Agree	4
5. Offering freebies and warranties	4.22	Agree	1
Average	**4.04**	**Agree**	

As shown in Table 9 that all five indicators related to after sales service were all rated agree. Specifically indicator 5 rank 1 with a weighted mean of 4.22, followed by indicator 1 with a weighted mean of 4.12 rank 2 indicator 2 with a weighted mean of 3.94 rank 3, indicator 4 with a weighted mean of 3.92 rank 4, while indicator 3 with a weighted mean of 3.90 rank 5. Taking as a whole the five indicators, the average weighted mean of 4.02 is rated as agree.

Table 10

Analysis of Six Selected Attributes of Mobile Phone as Perceived by the Respondents

Price	R	Social Group	R	Brand	R	Product	R	Quality	R	After Sale	R
3.95	16	3.70	9	4.16	24.5	4.47	30	4.16	24.5	4.12	20
3.72	10	3.53	6	3.67	8	4.13	21	4.30	27	3.90	15
4.37	29	3.52	5	3.85	11	4.35	28	4.00	17	3.90	13
3.89	12	3.23	3	3.44	4	4.10	19	4.14	22	3.92	14
3.61	7	3.13	1	3.18	2	4.20	25	4.02	18	4.22	26
N^1 5	74	N^2 5	24	N^3 49	49	N^4 51	51	N^5 108	51	08.5	88

Table 10 shows the analysis of six selected attributes of mobile phone as perceived by the respondents of the six attributes the respondents rated agree on the five contributes such as price, brand, product features, quality and other sales service while the social group was rated moderately agree. It could be said that these attributes are acceptable criteria in the determination of the buying preference of mobile phones of the two groups of employees.

Sub-problem Number 3. Is there significant difference with regards to the six preferred attributes in the purchase of mobile phone by two groups of employees?

To determine the significant difference of the six preferred attributes of mobile phone as perceived by the respondents the krustal-wallis test or the H-test is applied.

Attributes	Sum of Rank	H	Computed Tabulated X2 Value	Decision	Significance
Price	74	18.42	11.07	Ho Rejected	With Significant Difference
Social Group	24				
Brand	49.5				
Product Feature	123				
Quality	108				
After Sale Service	88				

Since the H compound value of 18.32 is greater than X2 tabular of 11.07 value at.05 level of significance and 5 degrees of freedom we disconfirm the null hypothesis and accept the alternative hypothesis that there exist a significant difference on the six attributes as perceived by the respondents.

SUMMARY OF FINDINGS

The salient findings of the study as follows:

1. The perception of respondents (i.e, prospective buyers/consumers of mobile phones from two groups of respondents, relative to their profile in terms of:

    1.1 Age. Base on the data it shows that most of the respondents are young.

    1.2 Sex. It shows that most of the respondents were female.

    1.3 Civil Status. Shows in the table that majority of the respondents were single.

2. Assessment/analysis of six preferred attributes of mobile phone as perceived by the respondents.

It could be surmised that the six preferred attributes of mobile phone as perceived by the respondents are acceptable criteria in the determination of the buying preference of mobile phones by the two groups of respondents.

3. Is there significant difference with regard the six preferred attributes in the purchase of mobile phone by the two groups of respondents.

There exists a significant difference on the six attributes as perceived by the respondents.

Since the H compound value of 18.32 is greater than X2 tabular of 11.07 value at.05 level of significance and 5 degrees of freedom we disconfirm the null hypothesis and accept the alternative hypothesis that there exist a significant difference on the six attributes as perceived by the respondents.

CONCLUSIONS

In the light of the above finding, the following conclusions were drawn.

1. Majority are young female working employees are single.

2. Using six preferred attributes of mobile phones the respondent rated agree on the five contributes such as price, brand, product features, quality and sales service while social group was rated moderately agree.

3. Apparently, there exist a significant difference in the assessment of the six attributes.

RECOMMENDATIONS

Taking into the account the findings and conclusions of the following recommendations are made.

1. Priority in terms of emphasizing creativeness and innovative approach in the production of mobile phone should be push through in order that continuous demand from buying public will be maintained as a preferred criteria.

2. Further research should be encourage or a similar study be conducted to confirm or update the results of the study.

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ASSESSMENT OF DOMESTIC AIR TRAVELERS ON AIRLINE RESERVATION

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INTRODUCTION

The fastest means of transportation is by air. Thousands of people choose the airline as means of transportation for them to be able to reach their destination within a short period of time. Globalization and technology introduce different and various kind of reservation for the convenience of the customers. Airline Reservation is booking a flight schedules, seat assignments and time of arrival and departure; it also includes passenger reservations and passenger reservation records. There are different ways these customers preferred to make their domestic airline ticket reservation. In Person, on line and through telephone are some of the ways to do airline reservation. Modern airline reservation is comprehensive suites of products to provide that assist with a variety of airline management tasks and service customer needs from the time of initial reservation through completion of the flight. The concept of reservation practiced is one of the most extensively researched areas specifically in Airline industry. Reservations are relayed between the costumers and the employees assigned on the airlines. This ensured that reservation process is thoroughly planned, organized and implemented.

The Philippine Airlines is a trade name of PAL Holdings, is the flag carrier of the Philippines. It's headquarter is located at the PNB Financial Center in Pasay City. It was founded in 1941 and is the first and oldest commercial airline in Asia operating under its original name. Out of its hubs at Ninoy Aquino International Airport of Manila and Mactan-Cebu International Airport of Cebu, Philippine Airlines serves 31 destinations in the Philippines and 41 overseas destinations in Southeast Asia, East Asia, Middle East, Oceania, North America and Europe.

Cebu Air, Inc., operating as Cebu Pacific, is a Philippine low-cost airline based on the grounds of Ninoy Aquino International Airport (Manila Terminal 3), Pasay City, Metro Manila, and the Philippines. It offers scheduled flights to both domestic and international destinations. Its main base is Ninoy Aquino International Airport, Manila, with other hubs at Mactan-Cebu International Airport, Clark International Airport, Kalibo International Airport, Francisco Bangoy International Airport, and Iloilo International Airport.

Secure and stable kinds of reservations are vital to the airline industry which is why companies spent many years designing an architecture specifically suited to the nature of the airline industry which often required tens of thousands of users and travelers to access and used them simultaneously.

STATEMENT OF THE PROBLEM

The study focused on the Assessment of Domestic Air Travelers on Airline Reservation.

Specifically, it sought to answer the following sub problems:

1. How do the respondents assess the Domestic Airline Reservation in Philippine Airlines and Cebu Pacific?

2. Is there a significant difference on the assessment of the respondents as to the Airline Reservation, when grouped according to the airlines?

3. What are the common problems encountered by the Domestic Air Travelers on the Airline Reservation?

SIGNIFICANCE OF THE STUDY

Reservation officers – this study is very important because the researchers gave light to those who are already employed as reservation officers and those who want to be a reservation officer. This research will serve as a ground for reservation officers to be successful in the endeavor they had chosen

Domestic Air Passengers - this study will help the passengers to determine the different mode of airline reservation for them to choose from.

Airline Company- this study will help travel agencies as a reference for their research on how they can serve their clients better.

Tourism Students – they may be equipped with knowledge about the nature of work of domestic airline reservation that they may apply when they are already in the industry.

Future Researchers- this study may help the future researcher for they may be acquired important data which can be used in their related future research studies.

LITERATURE AND STUDIES

According to Cayabyab (2012) only one in ten travelers in the Philippines books airlines flights and hotel accommodations while in Singapore the online booking rate is three times higher at 30 percent.

According to Kollau (2012) In the Philippines, passengers who book a ticket online for a domestic flight with Philippine Airlines and its low-cost subsidiary AirPhil Express, can pay for their ticket using cash at over 750 7-Eleven retail outlets nationwide which are open 24/7. The new scheme is designed for the large number of consumers in the Philippines who do not own a credit card and PAL says it wants to offer them the convenience to do their bookings online at home, office, internet cafe or via their mobile phone and then go the nearest 7-Eleven outlet in their neighborhood to make the payment.

French (2011) The USA has so far seen more intensive use of so-called ticketless travel, or electronic ticketing based on chip-cards, than has EUROPE. At the moment such schemes are some way from being introduced en masse into large sectors of Intra-European or international travel. The technical obstacles are formidable, but they are being addressed: a standard format for chip-cards, already agreed in the USA, has been passed onto the international air transport Association (IATA), which has already pioneered an advanced automated ticket and boarding pass, for evaluation for international services. The aim in the end is full automation from departure hall to aircraft, security excepted.

Maravanyika (2010) and French (2011), recognized that the general direction of traditional aviation literature in the past decade has been that there is disintermediation the number intermediaries in air travel have increased through the emergence of Internet-based

platforms. It has also been found that in regions with low electronic readiness and low electronic culture the internet has had little or no impact on business.

Cariquitan and Sangalang (2014) conducted a study on the perceived effectiveness of Global Distribution System (GDS) and its relation to the revenue growth of selected travel agencies in Laguna. Technology nowadays is going to be a useful tool for any types of individual. In the case of travel industry, a travel agent is a tool for people to travel to any parts of the world. They assist travelers as per their conveniences. However, as technology evolves, travel agencies are losing their value as a one-stop-shop for it can also be done by ordinary individuals. Anyone can reserve their flights through the internet and the use of their credit cards as a mode of payment.

According to Ikpeminoghena (2012) Airline flight information is used to track and maintain records of flight schedules, passenger reservations and seat assignments, aircraft loading, flight inventory, ticket purchases and fare tariffs. The modern airline reservation system also serves customer needs from beginning to end of each customer's reserved flight, therefore laying out management tasks for each flight.

Mittal (2012) stated on his study that the objective of the project is to design an Airline Reservation application which enables the customers to search and book flights. The Airline Reservation System project mainly consists of two types of users. The customers who access the information provided by the website and the administrator who modifies and updates the information.

METHODOLOGY

The study utilized the descriptive method of research. Descriptive research is devoted to the gathering of information about prevailing conditions or situations for the purposed of description and interpretation. This type of research method is not simply a means of gathering and tabulating facts but includes proper analyses, interpretation, comparisons, identifications of trends and relationships.

RESULTS AND DISCUSSION

Sub-problem No. 1: How do the respondents assess the Domestic Airline Reservation?

Table 1

Assessment of Respondents on Airline Reservation

Criteria	Philippine Airlines		Cebu Pacific		Composite	
	WM	VI	WM	VI	WM	VI
On-line Reservation	2.98	G	2.08	F	2.53	F
Telephone Reservation	3.35	G	2.55	F	2.95	G
In Person Reservation	3.68	G	4.58	E	4.13	VG
Overall Mean Values	**3.34**	**G**	**3.07**	**G**	**3.20**	**G**

As presented on Table 1, Philippine Airlines and Cebu Pacific Passengers has the rate of computed total weighted mean for the Airline Reservation of 3.20 with the verbal interpretation of Good (G).

Online Reservation has a weighted mean of 2.53 with a verbal interpretation of Fair (F); Telephone Reservation has a weighted mean of 2.95 with a verbal interpretation of Good (G). And the In Person Reservation has a weighted mean of 4.13 with a verbal interpretation of Very Good (VG).

Sub-problem No. 2: Is there a significant difference on the assessment of the respondents on the domestic airline reservation when grouped according to the airlines?

Table 2

Comparison of Assessment on the Respondents

Criteria	Philippine Airlines		Cebu Pacific		t values	VI	Decision
	WM	SD	WM	SD			
On-line Reservation	2.98	1.092	2.08	0.642	5.022	S	Reject Ho
Telephone Reservation	3.35	1.325	2.55	1.651	2.672	S	Reject Ho
In Person Reservation	3.68	1.098	4.58	0.804	4.678	S	Reject Ho

As presented in Table 2, Comparing the assessments of the respondents on Airline Reservation System of domestic travellers of Philippine Airlines and Cebu Pacific yielded overall t values of 5.022 for ”On-line Reservation,” 2.672 for “Telephone Reservation,” and 4.678 for “In Person Reservation,” which are more than the critical value of 2.000 at five percent level of significance and verbally interpreted as significant rejecting the null hypothesis that there is no significant difference on the assessment of the respondents on airline reservation based on selected variables.

This shows that the domestic travelers of Philippine Airlines and Cebu Pacific have similar perception with the airline reservation employed by Philippine Airlines and Cebu Pacific.

Sub-problem No. 3: What are the common problems encountered by the respondents on domestic airline reservation?

As reflected in table 3, the Employee behavior ranks first with a weighted mean of 4.54 and a verbal interpretation of Highly Encountered (HE); Computer Failure ranks second with a weighted mean of 3.98 and a verbal interpretation of Encountered (E); Telephone rings too long before being answered ranks third with a weighted mean of 3.61 and a verbal interpretation of Encountered (E); Rank 4^{th} is Failure to listen properly to request and questions with a weighted mean of 3.40 and a verbal interpretation of Encountered (E); Rank five is Lack of professionalism with a weighted mean of 3.35 and a verbal interpretation of Moderately Encountered (ME); Rank six is Lack of product knowledge with a weighted mean of 2.94 and a verbal interpretation of Moderately Encountered (ME); Limited time given to pay the reservation with a weighted mean of 2.91 and a verbal interpretation of Moderately Encountered (ME);

Being placed on hold for too long ranks seventh with a weighted mean of 2.32 and a verbal interpretation of Slightly Encountered (SE); Rank eight is Inability to get through, line is always busy with a weighted mean of 2.06 and a verbal interpretation of Slightly Encountered (SE).

Table 3

Problems Encountered in Airline Reservation

Problems Encountered	Philippine Airlines		Cebu Pacific		Total	
	F	%	F	%	F	%
Employees behaviour	4.52	HE	4.56	HE	4.54	HE
Computer Failure	3.64	E	4.32	HE	3.98	E
Telephone rings too long before being answered	3.62	E	3.60	E	3.61	E
Failure to listen properly to request and questions	3.46	E	3.34	ME	3.40	E
Lack of professionalism	3.32	ME	3.38	ME	3.35	ME
Lack of product knowledge	2.76	ME	3.12	ME	2.94	ME
Limited time given to pay the reservation	3.12	ME	2.70	ME	2.91	ME
Being placed on hold for too long	2.64	ME	2.00	SE	2.32	SE
Inability to get through, line is always busy	2.82	ME	1.30	NE	2.06	SE
Overall Mean Values	**3.32**	**ME**	**3.15**	**ME**	**3.32**	**ME**

As a whole, the most common problems encountered by respondents on domestic airline reservation, are the following; employees behavior, computer failure, telephone rings too long before being answered, failure to listen properly to requests and questions, lack of professionalism and lack of product knowledge.

CONCLUSIONS AND RECOMMENDATIONS

The following conclusions are hereby drawn from the findings of the study:

1. The respondents rated the domestic airline reservation of the two airline company as Good.

2. There is no significant difference on the assessment of the respondents as to the mode of reservation of domestic airline reservation.

3. There were problems encountered by both passengers of Philippine Airline and Cebu Pacific Air on the domestic airline reservation such as employees' behavior, computer failure, telephone rings too long before being answered, failure to listen properly to requests and questions, lack of professionalism and lack of product knowledge.

Based on the given findings and conclusions of the study, the following recommendations are drawn:

1. The two airline companies should improve the reservation system on domestic airline reservation for the convenience and satisfaction of the domestic air travelers.

2. Reservation officers may practice proper handling of guest complaints and other problems that concerns in their reservation to avoid miscommunication and the possible problem that maybe encountered with the customers.

3. The reservation officers should show professionalism in dealing their clients at all times.

4. It is important that every reservation officers have knowledge on their products and services being offered to their clients.

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