MISCONCEPTIONS ON THE USE OF STATISTICAL TOOLS IN AGRICULTURAL RESEARCHES IN ZAMBOANGA DEL NORTE, PHILIPPINES: BASIS FOR PROFESSIONAL DEVELOPMENT

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Introduction

I used to sit as a panel member for graduate theses defense in two private Colleges in Dipolog City, Zamboanga del Norte, Philippines. One time, almost a month before a certain oral defense, I had read the entire manuscript of two theses which were agricultural in nature and I found out some inappropriate statistical tools used in the two studies and such were figured out during the oral defense and were finally corrected. A month later, I came across of reading a local research journal in agriculture and being a Mathematics and Statistics mentor, I took a serious focus on the statistical tools used in the different researches within the journal. I noticed that some of the researchers had utilized statistical tools inappropriate to the research problems. After sometime and after an intense reflection on what I have noticed in the two aforementioned situations, I conceptualized this research paper adhering to the premise that "inappropriate statistical tools in research lead to inappropriate research findings.

The Study

This study sought to determine the misconceptions on the use of statistical tools in agricultural researches in Zamboanga del Norte, Philippines with an intention of offering a professional development in Statistics and Research. I operationally defined misconceptions in this study as the incorrect or inappropriate use of statistical tools in research and the professional development as an intensive training for agricultural researchers which is mainly focused on the choice of appropriate statistical tools in conducting research with emphasis on the use of technology. Moreover, the term misconceptions is also defined as the incorrect or inappropriate statistical interpretation as found in research findings.

A documentary analysis was conducted among agricultural researches in the following government agencies in Zamboanga del Norte, Philippines: Bureau of Agricultural Statistics, Department of Agriculture in Dipolog and Dapitan Cities; Department of Agriculture in the Municipalities of Katipunan, Polanco,Sibutad, La Libertad, Rizal, Roxas, Manukan, Sindangan,, Leon Postigo, Salug, Liloy, Labason, Gutalac, Sergio Osmena and Tampilisan. Each of the researches was examined by a three-man panel in terms of the appropriateness of statistical tools that were used. A thorough evaluation was conducted and misconceptions on the used of statistical tools were recorded, analyzed and interpreted.

`Prior to the evaluation process, the three-man panel which included myself set specific

criteria on how to conduct the documentary analysis and on how to undergo the evaluation process in order to obtain valid results. The criteria set by the three-man panel was further subjected to validity and reliability testing to ensure utmost accuracy of the research findings.

The Results and Discussions

Table 1 shows the number of agricultural researches conducted in the cities and municipalities of Zamboanga del Norte.

Table 1

Number of Agricultural Researches in Zambonaga del Norte, Philippines and the Number of Researches with Misconceptions

City/Municipality	Number of Researches	Number of Researches with Misconceptions
Dipolog	10	10
Dapitan	8	8
Katipunan	5	5
Polanco	3	3
Sibutad	2	2
La Libertad	1	1
Rizal	3	3
Roxas	3	3
Manukan	2	2
Sindangan	4	4
Leon Postigo	1	1
Salug	4	4
Liloy	4	4
Labason	2	2
Gutalac	1	1
Sergio Osmena	1	1
Tampilisan	2	2
Total	56	56

As shown in table 1, there were 56 agricultural researches conducted in the province of Zamboanga del norte and this constituted the total population of my study. As further reflected in the table, all of these 56 researches had misconceptions on the choice of statistical tools. Table 2 further shows the specific misconceptions.

Table 2
Specific Misconceptions on the Choice of Statistical Tools by City/Municipality

City/Municipality	Area of Misconceptions
Dipolog	Analysis of Variance and Statistical Inference
Dapitan	Choice Between Parametric and Nonparametric Tests and Statistical Inference
Katipunan	Sampling Techniques, Sample Size, Choice Between Parametric and Nonparametric Tests, Confidence Interval, Statistical Inference and Analysis of Variance
Polanco	Sampling Techniques, Statistical Inference and Analysis of Variance
Sibutad	Choice Between Parametric and Nonparametric Tests, Confidence Interval, Statistical Inference and Analysis of Variance
La Libertad	Sampling Techniques, Sample Size, Choice Between Parametric and Nonparametric Tests, Confidence Interval, Statistical Inference and Analysis of Variance
Rizal	Choice Between Parametric and Nonparametric Tests, Confidence Interval, Statistical Inference and Analysis of Variance
Roxas	Sampling Techniques, Sample Size, Choice Between Parametric and Nonparametric Tests, Confidence Interval, Statistical Inference and Analysis of Variance
Manukan	Statistical Inference and Analysis of Variance
Sindangan	Sampling Techniques, Sample Size, Choice Between Parametric and Nonparametric Tests, Confidence Interval, Statistical Inference and Analysis of Variance
Leon Postigo	Choice Between Parametric and Nonparametric Tests, Confidence Interval, Statistical Inference and Analysis of Variance
Salug	Confidence Interval, Statistical Inference and Analysis of Variance
Liloy	Confidence Interval, Statistical Inference and Analysis of Variance
Labason	Sampling Techniques, Sample Size, Choice Between Parametric and Nonparametric Tests, Statistical Inference and Confidence Interval
Gutalac	

Sergio Osmena	Confidence Interval, Statistical Inference and Analysis of Variance
Tampilisan	Analysis of Variance and Statistical Inference

As viewed from table 2, the misconceptions of the 56 agricultural researches reviewed were in terms of: Sampling Techniques, Sample Size, Choice between Parametric and Nonparametric Tests, Confidence Interval, Statistical Inference and Analysis of Variance.

In terms of sampling techniques and sample sizes: the three-man panel found out that there was inappropriate choice for these tools like the choice between random and nonrandom sampling techniques and on the calculation of appropriate sample sizes based on the level of significance of the study.

For choice between parametric and nonparametric Tests: the three-man panel found out that some researchers used parametric tests instead of nonparametric and some used nonparametric tests instead of parametric and that these researchers did not consider the assumptions underlying the tests. Some of the researchers did not consider the fact that parametric is more powerful that nonparametric test as cited by Pallant (2001).

As to confidence interval: the three-man panel found out that some researchers mentioned about "confidence interval" to estimate the population mean but what has been presented in he study was the sample mean only, the confidence interval was not presented.

Illustration 1 as found in some of the reviewed researches:

Category	Sample Mean
Group A (n=100)	85

From this presentation, the confidence interval is not presented. If the researcher intended to present the confidence interval then it would have been idealls like the following:

Illustration 2 for 95% Confidence Interval

Category	Sample Mean	Sample Standard Deviation	95% Confidence Interval
Group A (n=100)	85	1.5	82.06-87.94

Illustration 3 for 99% Confidence Interval

Category	Sample Mean	Sample Standard Deviation	99% Confidence Interval
Group A (n=100)	85	1.5	81.13-88.87

In terms of statistical inference: the three-man panel found out that all of the 56 reviewed researches stated that: "There is no significant difference between the experimental and control groups and nothing follows." In Statistics language, it would have been stated as: "The sample data has not provided sufficient evidence to conclude that there is a difference between the experimental and control groups." OR "The sample data has not provided sufficient evidence to conclude that the

experimental group is **(more effective)** or **(better than)** or **(less effective)** than the control group.

For the one-way Analysis of Variance: the three-man panel found out that majority of the reviewed researches stated that: "There is a significant difference among the three, four, five or six groups and nothing follows." Since there is a significant difference found in the overall ANOVA, the researchers should have performed a post-hoc test in order to find out where the differences among the groups occur.

With the aforementioned findings, I was curious enough of going into the educational qualifications of the agricultural researchers involved of my study. I conducted an interview to more than half of these researchers focusing on their educational qualifications specifically on research and statistics. The interview revealed that these researchers did not have formal training about research and statistics hence, a professional development was further conceptualized.

The Professional Development

Based on the findings of my study, I conceptualized a professional development in Statistics and Research focusing on the choice of appropriate statistical tools and technology integration. On the other hand, it is also aimed that participants in the professional development would be able to write appropriate statistical interpretations. The course was focused on descriptive statistics, probability, discrete probability distributions, normal probability distributions, confidence intervals, hypothesis testing, correlation and regression, chi-square test and F distribution. Parametric and nonparametric choice of tests were intensively focused.

I proposed first this professional development program to the University President, the Vice President for Academic Affairs as well as to the Director for Extension Services of the Jose Rizal Memorial State University System and I was then given the approval to conduct the program. Program guidelines, implementation procedures, funding sources were intensively identified and established. A Memorandum of Agreement between JRMSU and the agencies where the researchers belong was also established before starting the program. The participants signed a contract of agreement that they should successfully complete the program.

The following were taken in the entire program:

Unit I – Exploring Data

A. Interpreting graphical displays of distributions of univariate data like:dot plots, stem plots, histograms, cumulative frequency plots
    1. Center and spread
    2. Clusters and gaps
    3. Outliers and other unusual features
    4. Shape

B. Summarizing distributions of univariate data
    1. Measuring center: median and mean
    2. Measuring spread: range, interquartile range, standard deviation
    3. Measuring position: quartiles, percentiles, standardized scores or *z*-scores

C. Comparing distributions of univariate data like: dot plots, back-to-back stem plots, parallel box plots
    1. Comparing center and spread: within group, between group variation
    2. Comparing clusters and gaps
    3. Comparing outliers and other unusual features
    4. Comparing shapes

D. Exploring bivariate data
    1. Analyzing patterns in scatter plots
    2. Correlation and linearity
    3. Least-squares regression line
    4. Residual plots, outliers and influential points
    5. Transformations to achieve linearity: logarithmic and power transformations

E. Exploring categorical data: frequency tables
    1. Marginal and joint frequencies for two-way tables
    2. Conditional relative frequencies and association

Unit II – Planning a Study

A. Overview of methods of data collection
    1. Census
    2. Sample survey
    3. Experiment
    4. Observational study

B. Planning and conducting surveys
    1. Characteristics of a well-designed and well-conducted survey
    2. Populations, samples and random selection
    3. Sources of bias in surveys
    4. Simple random sampling
    5. Stratified random sampling

C. Planning and conducting experiments
    1. Characteristics of a well-designed and well-conducted experiment
    2. Treatments, control groups, experimental units, random assignments, and replication
    3. Sources of bias and confounding, including placebo effect and blinding
    4. Completely randomized design
    5. Randomized block design, including matched pairs design

D. Generalizability of results from observational studies, experimental studies, and surveys

Unit III – Anticipating Patterns

A. Probability as a relative frequency
    1. Law of Large Numbers
    2. Addition rule, multiplication rule, conditional probability, and independence
    3. Discrete random variables and their probability distributions, including binomial

4. Simulation of probability distributions, including binomial and geometric
5. Mean (expected value) and standard deviation of a random variable, and linear transformation of a random variable

B. Combining independent random variables
   1. Notion of independence versus dependence
   2. Mean and standard deviation for sums and differences of independent random variables

C. The normal distribution
   1. Properties of the normal distribution
   2. Using tables of the normal distribution
   3. The normal distribution as a model for measurements

D. Sampling distributions
   1. Sampling distribution of a sample proportion
   2. Sampling distribution of a sample mean
   3. Central Limit Theorem
   4. Sampling distribution of a difference between two independent sample proportions
   5. Sampling distribution of a difference between two independent sample means
   6. Simulation of sampling distributions

Instruction was done using the "I Do, We Do and You Do" models of teaching. Participants were graded based on the JRMSU grading policies. Microsoft Excel Data Analysis ToolPak, Calculators and SPSS were used in the program. Pre-test and post-test were utilized to determine the effectiveness of the professional development program. Statistical analysis revealed that there was a sufficient evidence to conclude that there was a difference between the pre-test and post- test in favor of the post test which implied an effectiveness of the professional development program After successfully completing all the requirements, the participants received a "Certificate of Training" during the graduation ceremony of the program.

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RÉSUMÉ (ABSTRACT)

This study sought to determine the misconceptions on the use of statistical tools in agricultural researches in Zamboanga del Norte, Philippines with an endview of offering a professional development in Statistics and Research.

A documentary analysis was conducted among agricultural researches in the government agencies in Zamboanga del Norte Philippines. Each of the researches was examined by a three-man panel in terms of the appropriateness of statistical tools that were used.

It is concluded that there were many misconceptions on the use of statistical tools in agricultural researches in Zamboanga del Norte, Philippines specifically on confidence intervals and in the making of statistical inferences. In line with this conclusion through an allocated budget from the government and other private agencies, a professional development in Statistics and Research was conducted focusing on the choice of appropriate statistical tools and technology integration. Statistical analysis revealed that there was a sufficient evidence to conclude that there was a difference between the pre-test and post- test in favor of the post test which implied an effectiveness of the professional development program.

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