STATISTICAL LITERACY AMONG BARANGAY OFFICIALS AND SENIOR HIGH SCHOOL STUDENTS: A UNIVERSITY OUTREACH PROGRAM

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ABSTRACT

This paper presents on how I conducted the statistical literacy program among barangay (village) officials and how these officials applied what they have learned in their respective barangays. Moreover, I portrayed in this paper how I provided an intensive program for an introductory statistics course which is called "Senior High School Students Literacy Program" with an objective of providing initial knowledge in Statistics to the participants, win statistics quiz contest as well as encouraging them to pursue a degree in Statistics. The programs for both barangay officials and senior high school students gained positive results as manifested on: 1). how the barangay officials collected, presented and analyzed data on their respective barangays 2). how the senior students won statistics quiz contest conducted by the NSO of the Philippines and the PSA and 3). the number of students who pursued BS Statistics degree.

INTRODUCTION

The National Budget Circular (NBC) 461of the Republic of the Philippines is issued and established for the position classification and compensation scheme for faculty position in State Universities and Colleges (SUCs), Commission on Higher Education (CHED) Supervised Higher Education Institutions (HEIs) and Technical Education and Skills Development Authority (TESDA) Supervised Technical Education Institutions (TEIs). The NBC 461 mandates that teaching position involves four functional components: Instruction, Research, Extension and Production. Instructors and Assistant Professors should function in instruction effectiveness, Associate Professors should function effectively in any two of the four components, and Professors should function effectively in any of the four.

As one of the Associate Professors of Jose Rizal Memorial State University (JRMSU) System, Dapitan City, Philippines and who is aiming to be Professor in the future, I decided to function in Instruction, Research and Extension. Thus, I am able to conceptualize this paper to function as what has been mandated by NBC 461 and at the same time improve the statistical literacy in the province of Zamboanga del Norte, Philippines where JRMSU system is located.

THE SENIOR HIGH SCHOOL STUDENTS STATISTICAL LITERACY PROGRAM

Every year, the National Statistics Office (NSO) of the Philippines and the Philippine Statistical Association (PSA) conduct the Philippine Statistics Quiz (PSQ). The main objectives of PSQ are to instill the value of statistics among students and to win public cooperation in all government statistical activities such as censuses and surveys, and eventually generate quality data for national development planning. The PSQ is also designed to measure the effectiveness of the current statistics curriculum in high school and determine possible areas for improvement so that college entrants inclined in the sciences will develop more interest in statistical courses. The PSQ is categorized in three levels: Provincial, Regional and National. The JRMSU Main Campus joined the PSQ for the first time in 2002 and I was designated as the coach for the provincial level and for the next levels should we succeed. It was so difficult for me to scout and train contestant since contestant must be freshman and that I did not have enough knowledge on who was good in statistics among this group of students in the university. In my own initiative with the approval of the University President, I organized and launched a "JRMSU Statistics Quiz." I sent letters of invitation to all colleges of the University and asked support from the different deans as well as the Vice President for Academic Affairs. The winner of the university Quiz was

our first contestant in the Provincial level of the PSQ. I got a hard time in coaching because of time constraints and some learning barriers of the contestant. Despite such reasons we won the provincial level but did not make it in the regional level. Our failure in the regional level made me think on what should be done in the next school years to win in the PSQ and I finally conceptualized this program "Senior High School Students Statistical Literacy Program" with the objective of providing an intensive knowledge in introductory statistics course as well as scouting who will be the probable contestant for the PSQ. Moreover, it is viewed that the program might encourage senior high school students to pursue a degree in Statistics.

On the other angle of the program, it would benefit me as an associate professor of the university who is functioning in the areas of instruction, research and extension activities as mandated in NBC 461.I proposed the program to the University President, the Vice President for Academic Affairs as well as to the Director for Extension Services and I was given the approval to conduct the program. Program guidelines, implementation procedures, funding sources were intensively identified and established. Since this is an intensive program, some benefits were offered to the participants especially the deserving ones, and that funding is limited, a qualifying test was administered to determine the final participants of the program. Only those who would like to study in JRMSU were qualified to take the test. A total of 30 senior high school students passed the test and these 30 seniors signed a contract of agreement that they should definitely enroll in JRMSU for school year 2003-2004 and that they should successfully complete the program from January 2003 to April 2003. It is also indicated in the contract that whoever obtains the highest grade in the program would be the contestant for PSQ 2003 and that he/she should be willing to be trained further during the first semester of school year 2003-2004 in order to be well prepared for the contest.

The program covered descriptive and inferential statistics with emphasis on the use of available technologies like Microsoft Excel Data Analysis Toolpak, Calculators and Statistical Package for the Social Sciences (SPSS).The following were covered in the program:

I. Organizing Data
- A. Exploring Data
  - 1. Displaying Distributions with Graphs
    - a. Bar Graphs
    - b. Pie Charts
    - c. Dot plots and Stem plots
    - d. Histograms
  - 2. Describing Distributions with Numbers
    - a. Mean v. Median
    - b. Quartiles
    - c. Boxplots and the Five-Number Summary
    - d. Standard Deviation
    - e. Linear Transformations
- B. The Normal Distributions
  - 1. Density Curves and the Normal Distributions
    - a. Mean and Median
  - 2. Standard Normal Calculations
    - a. Standardizing and Z-Scores
    - b. Using Tables
    - c. Normal Proportions
- C. Examining Relationships
  - 1. Scatterplots
    - a. Analysis of Positive and Negative Association
  - 2. Correlation
  - 3. Least-Squares Regression
    - a. Least-Squares Regression Line

- b. Residuals and Influential Points
- D. More on Two-Variable Data
  - 1. Transforming Relationships
    - a. Monotonic Functions
    - b. Linear v. Exponential Growth
  - 2. Cautions about Correlation and Regression
  - 3. Relations in Categorical Data

II. Producing Data: Samples, Experiments, and Simulations

- Producing Data
  - 1. Designing Samples
    - a. Bias
    - b. Sampling Methods
  - 2. Designing Experiments
    - a. Randomization
    - b. Statistical Significance
  - 3. Simulating Experiments

III. Probability: Foundations of Inference

- A. Probability: The Study of Randomness
  - 1. The Idea of Probability
  - 2. Probability Models
    - a. Multiplication Principle
  - 3. General Probability Rules
    - a. Addition Rule
    - b. Conditional Probability
- B. Random Variables
  - 1. Discrete and Continuous Random Variables
  - 2. Means and Variance of Random Variables
    - a. Law of Large Numbers
- C. The Binomial and Geometric Distributions
  - 1. The Binomial Distributions
    - a. Binomial Probabilities
    - b. Mean and Standard Deviation
    - c. Normal Approximation
  - 2. The Geometric Distributions
    - a. Geometric Probabilities
    - b. Expected Value
- D. Sampling Distributions
  - 1. Sampling Distributions
    - a. Bias v. Variability
  - 2. Sample Proportions
  - 3. Sample Means
    - a. Central Limit Theorem

IV. Inference

- A. Introduction to Inference
  - 1. Estimating with Confidence
    - a. Confidence Intervals
  - 2. Tests of Significance
    - a. Null Hypothesis
    - b. P-Values
  - 3. Making Sense of Statistical Significance
  - 4. Inference as a Decision

a. Type I and Type II Errors
b. Power

B. Inference for Distributions
1. Inference for the Mean of a Population
a. Standard Error and t Distributions
2. Comparing Two Means

C. Inference for Proportions
1. Inference for a Population Proportion
2. Comparing Two Proportions

D. Inference for Tables: Chi-Square Procedures
1. Test for Goodness of Fit
a. Chi-Square Distributions
2. Inference for Two-Way Tables
a. Chi-Square Test for Homogeneity
b. Test of Association/Independence

E. Inference for Regression
1. Inference about the Model
a. Regression Model
b. Confidence Intervals for the Regression Slope
2. Predictions and Conditions

Classes were conducted every Saturday 8:00-12 and 1:00-5:00 at JRMSU which started January 2003 to March 2003 for a total of 12 Saturdays which is equivalent to 96 hours of face to face contact in the classroom. Instruction was done using the "I Do, We Do and You Do" Models of teaching. In addition, after completing the 96 hours of instruction in the classroom, the participants were sent to the NSO and Bureau of Agricultural Statistics (BAS) for practicum for five working days or 40 hours, 8 hours per day to expose them on the different applications of statistics. The practicum was done on the second week of April 2003 from Monday to Friday. Before sending the participants to the aforementioned agencies, a Memorandum of Agreement between JRMSU and NSO and between JRMSU and BAS were established. Students received the following benefits while participating the program: 1).Three unit credit in Introductory Statistics Course in JRMSU should they obtain a final grade of A in the Program; 2).Free transportation, lunch and snacks for the entire duration of the program; and 3).Certificate of Training during the graduation ceremony.

THE BARANGAY OFFICIALS STATISTICAL LITERACY PROGRAM

Oftentimes, I went to the Office of our barangay officials in Olingan, Dipolog City, province of Zamboanga del Norte Philippines to secure Barangay Clearance, Certification for general purposes and to pay community tax. While visiting the office, my attention was caught by barangay data like: number of births, number of deaths, total population, etc. which were not appropriately collected and presented. I went to other barangays to find out if similar things were true and I found out that almost all, 90% of the barangays that I visited within Dipolog City had similar errors in collecting, presenting and analyzing data. Being a Mathematics and Statistics Educator, I was so concerned about what I had observed and surveyed. Hence, I conducted formal interviews with concern barangay officials about basic statistical issues and problems in collecting, presenting and analyzing data in their respective barangays. All of those that I had interviewed felt problems about knowledge in basic statistics knowing that 95% of these barangay officials were not degree holders. I did a review on the duties and responsibilities of these officials and conceptualized "a literacy program for them." This program was limited only to descriptive statistics as this is the aspect of statistics that were needed based on my initial survey of their duties and responsibilities. I proposed this to the University President, the Vice President for Academic Affairs as well as to the Director for Extension Services and I was 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 Department of Interior and Local Government (DILG) were the barangay officials belong was also established before starting the program. The participants signed a contract of agreement that they should successfully complete the program from July 2003 to December 2003.

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

Classes were conducted every sunday 8:00-12 at JRMSU which started July 2003 to December 2003 for a total of 24 sundays which is equivalent to 96 hours of face to face contact in the classroom. Instruction was done using the "I Do, We Do and You Do" Models of teaching. Microsoft Excel Data Analysis ToolPak, Calculators and SPSS were used in the program. However, the medium of instruction was Cebuano, the dialect of Zamboanga del Norte where 100% of the concern barangay officials were proficient. Before using the technology in Statistics, the basics in operating computers were emphasized first because 95% of these barangay officials were not computer literate. To ensure 100% attendance and to motivate these officials to participate in the program, free transportation, lunch and snacks for the entire duration of the program were provided. After successfully completing all the requirements, the barangay officials received a "Certificate of Training" during the graduation ceremony of the program.

EVALUATION OF THE PROGRAMS

Grades were given to the participants of the two programs using the JRMSU grading system. Participants took quizzes and formal assessments like midterm and final examinations aside from doing classwork and homework activities. To further engage the participants, graded oral presentation of outputs were conducted. Pre-test and post-test were administered to both programs: the Senior High School Students Statistical Literacy Program and the Barangay Officials Statistical Literacy Program. For both programs, average scores in the post-test were much higher than the pre-test scores which indicates that something is learned from the program.

To further evaluate the effectiveness of the program, I visited the respective barangays of the particpants to conduct authentic assessment and I found significant changes on the way they presented data and the way they designed simple barangay surveys. Fortunately, each of the barangays involved in the statistical literacy program were issued computers by the DILG and luckily all barangay data were presented using Microsoft Excel Data Analysis Toolpak. Since the first implementation of the program in 2003 until the present, JRMSU continues to undergo the program to respective barangay units involved in the program.

For the Senior High School Students Literacy Program, JRMSU won again in the provincial level of PSQ 2003 with remarkably higher score than in PSQ 2002 by about 70% and JRMSU won the third

place in the regional level with about 100% increase of the score. Until the present, JRMSU continues to join PSQ and obtains first places in the provincial level, within the top three places in the regional level and never been yet in the national level.

In the past years prior to 2003, as I surveyed in Zamboanga del Norte, an average of three senior high school students took up BS Statistics. Out of the 30 participants in the program 11 actually enrolled in the BS Statistics Program in which I believe the statistical literacy program impacted this figure of taking up degree for Statistics.

CONCLUSION

The Statistical Literacy Programs for both barangay officials and senior high school students gained positive results as manifested on: 1). how the barangay officials collected, presented and analyzed data on their respective barangays and 2). how the senior students won statistics quiz contest conducted by the NSO of the Philippines and PSA as well as the number of students who pursued BS Statistics degree program.

Hence, given enough funding for the program and appropriate support from concern agencies and individuals, these two programs are found beneficial as revealed in this study.

Since the first implementation of these two programs in 2003, they are continually and successfully implemented up to the present despite the meager financial resources. It is hoped that this initiative would be given more financial budget allocation in order to progress the programs in the future.

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