

RESEARCH ARTICLE

CONJECTURING HIGHER COMPETENCIES IN STATISTICS USING SCIENTIFIC CALCULATOR.

Adriel G. Roman.

Laguna State Polytechnic University, Laguna, Philippines.

.....

Manuscript Info

Abstract

Manuscript History Received: 06 September 2018 Final Accepted: 08 October 2018 Published: November 2018

*Keywords:-*Statistics Scientific Calculator.

..... Teaching Statistics using traditional method tend to be quite time consuming which will result to insuffiency to higher competencies. This research on utilizing Scientific calculator in teaching selected topics in Statistics was conducted in one state university involving 30 senior high school students. The primary goal of the study was to attain higher competencies in Statistics by mastering the basics with the aid of scientific calculator. A quasi-experimental design with one sample pretest post-test approach was used. The statistical tools used in the data analysis were the descriptive statistics and paired t-test. The findings from the study showed that there is a significant improvement in the respondents level of competencies in descriptive Statistics after the utilization of scientific calculator. It was also found out that students showed higher competencies in higher statistical concepts (inferentials) after applying their learnings on descriptive Statistics. Finally, the research concluded that teaching Statistics using Scientific Calculator helps students achieve higher learning in advanced statistical concepts.

Copy Right, IJAR, 2018,. All rights reserved.

Introduction:-

Statistics has been considered as a toolkit in doing research. In addition, it plays a very significant role in man's life. Statistics has proven its usefulness from ancient civilizations upto the modern period in a same way as technology. In the Philippines, as part of the Enhanced Basic Education Curriculum of the Department of Education through RA 10533, Senior High School was commenced in 2013. One of the salient features of this K-12 is the implementation of the Core Subjects. Since its implementation, general education subjects in the higher education were moved as Core Subjects in the Senior High School.

Statistics and Probability is one of the general education subjects in college that was moved to Senior High School. In this subject, the students are expected to know how to find the mean and variance of a random variable; to apply sampling techniques and distribution, estimate population mean and proportion, perform hypothesis testing, correlation and regression (Curriculum Guide, 2013). Although, the concept of Statistics and Probability is already integrated in the Grade 8 Mathematics, still several studies suggested that there is a need to improve the skills and competencies of the students in this discipline (Bersales, 2010). Studies found that competencies in Statistics can be enhanced using scientific calculator (Jacob 2012, Real 2013, and Pedron, 2016). In a school where teachers and students interact in the language of mathematics, the proper use of a calculator is indeed an imperative (Jacob, 2012 & Real, 2013, Pedron, 2016). Teaching and learning process will be smooth if the teacher facilitates well the students, and the students discover themselves. A variety of instructional methods and aid are required for successful

outcomes. Accordingly, Boon et al. (2009) proposed that calculator is also a tool for learning aside from doing bulk of calculations.

In this study, the one-sample pre-test post-test design was utilized for determining the effectiveness of using Scientific Calculator in teaching basic concepts in Statistics. Then, the gained performance of the students served as their inputs for learning advanced Statistical concepts. The final measurement of the study was the performances of the students in Advanced Statistics particularly in applying Inferential Statistical treatments using hypothesis testing procedure.



Figure 1:-Research Paradigm

Research Questions

This study was conducted to utilize scientific calculator in teaching selected topics in descriptive statistics. In particular, it successfully provides answers to the following queries:

- 1. Is there a significant improvement on the performance of the respondents in Basic Statistics after utilizing Scientific Calculator?
- 2. What is the level of competency of the students in selected topics in Inferential Statistics?

Hypotheses

This study hypothesized that the utilization of scientific calculator would not give any significant improvement on the performance of students.

Respondents of the Study

This study was focused on utilizing scientific calculator in selected topics in descriptive statistics. The respondents of the study were the Grade 11 students in one State University in Laguna, Philippines. It was composed of 30 students who were enrolled in Statistics and Probability class. They were purposively selected to be the subjects since they are the ones who enrolled in the Statistics class. The scientific calculator was utilized in discussing selected topics in descriptive statistics as follows: summations (square of sum and sum of squares), measures of central tendency and dispersion including quartiles, deciles, and percentiles. These selected topics were believed to have impact on learning higher competencies in Statistics.

Research Design

The aimed of this study was to utilize well the use of a scientific calculator in selected topics in Descriptive Statistics and determine its implication to advanced statistical concepts. The researcher employed One-Group Pretest-Posttest. In this approach, all participants belong to the experimental group. Then, two-time observations were done. One observation in the form of a pretest was recorded before the intervention (application of treatment). Then, a second is giving of posttest. Changes from the pretest to the posttest are the outcomes of interest, which are

presumed to be the result of the intervention. However, there is no comparison group. Finally, the respondents' performances in Inferential Statistics were recorded and analyzed.

Data Gathering Instrument

One of the instruments used in the study was a 30-item exam which was validated by experts in the field of Statistics in the University where the study was conducted. Internal consistency among the items was also checked using test-retest method. Multiple choice type of test was done in consonance to what the university has been practicing. The exam covered selected topics in measure of central tendency (mean), measures of variability (range, quartile deviation, semi-interquartile range, variance and standard deviation) and summations (as well as frequency distribution table). This 30-item validated multiple choice test served as the pretest and posttest. In addition, records of the students on their Inferential Statistics activities using hypothesis testing procedures for different Parametric Tests (Pearson's Correlation, Linear Regression, One Sample T-Test, Independent T-tests, One way and Two way Analysis of Variance) and 1 Non-Parametric test (Spearman Correlation) were analyzed.

Research Procedure

The researcher prepared a 30-item multiple choice type of test focusing on the basic principles in Statistics. This was subjected to validation, revision and finalization. After the determination of the significant difference between the pre-test and post test scores, nine (9) situational analysis problems (Spearman Correlation, Pearson Correlation, Linear Regression, One Sample T-test, T-test for independent samples (Assuming Unequal Variances and Assuming Equal Variances), One way analysis of variance (AnoVa) and two-way analysis of variance (AnoVa) were given to the students to apply of their knowledge gained on using scientific calculators. Each problem was allotted to one day for lecture and one day for formative assessment except for two-way analysis of variance in which two (2) days were allotted for lecture and two (2) days for formative assessment. The performances of the students were likewise analyzed and interpreted. To analyze the results of the study, Shapiro-Wilk's test was used to measure the normality of the distribution for both pre-test and post-test while Paired t-test was used to compare the significant difference.

Results and Discussions:-

Based on the result presented in table 1, the difference between the pre-test and post test results is significant as revealed by the probability value of <0.001. This means that after the utilization of Scientific Calculator, the performance of the students marked significant increase. This result provides an implication that teaching descriptive Statistics with the use of Scientific Calculator would result to advanced competencies that can be utilized in higher statistical concepts. The result of this study agrees with the findings of Ochanda and Indoshi (2011) that, since calculator is considered as a tool in performing computations, it can be used as instructional aid for concept development resulting to deep understanding particularly when students showed proficiency in their use. The result (solving non-linear equations) showed significant increase after teaching the technique to use the scientific calculator. Based on the interpretation, the result indicates that the utilization of Scientific Calculator in Teaching Selected Topics in Descriptive Statistics improves Statistical approaches such as performing statistical operations and giving inferences. Hence, mastery level of students in utilizing scientific calculator will lead them to advanced competencies.

Table 1Difference between the file fest and fost fest Result								
Statistics Value	Mean	Verbal Interpretation	Computed Value	P-Value	Difference			
Pre-Test	13.83	Satisfactory	9 387	< 0.001	Significant			
Post-Test	25.63	Excellent	2.307					

Table	1Di	fference	hetween	the	Pre.	Test	and	Post-	Test 1	Result
rable	1:-D	merence	Detween	uie	rie.	- Test	anu	rost-	rest	Result

After the experiment, the students were also subjected to do 40-hours follow-up activities. The forty (40) hours allotted was divided into 2. The first 20 hours was allotted to the discussion of some treatments focusing on Inferential Statistics. After each lesson, students were given activity using the hypothesis testing procedure. Selected topics in inferential Statistics were as follows: Pearson's Correlation, Spearman's Correlation, Simple Linear Regression, One-Sample T-test, T-test for Independent Samples (Assuming Unequal Variances), T-test for independent samples (Assuming Equal Variances), T-test for Correlation samples, One-way Analysis of Variance, and Two-way Analysis of Variance.

Based on the data presented in the table, students are at Very Satisfactory level in terms of Stating the Null and Alternative Hypothesis. They can identify the problem and construct hypotheses based on the given problem. As per computing test statistics, students performed excellently on the topics about Pearson's Correlation and One-Sample T-test while Very Satisfactory on the remaining topics. Students also performed in Very Satisfactory level in providing decision about the null hypothesis at different alpha levels (5%, 3%, 1%). Finally, in making conclusions, students performed excellently in Pearson's Correlation while Very Satisfactory on the topics about Spearman's Correlation, Linear Regression, One-Sample T-Test, and Satisfactory on the topics such as T-test for Unequal and Equal Variances, One-way and Two-way Analysis of Variance.

Although this study focused only on the application of Scientific Calculator in Teaching Descriptive Statistics using one-sample group design, it is interesting that the students showed Very Satisfactory Performance in selected inferential topics in Statistics. More interesting, they showed excellent performance in the basic test of Relationship (Pearson's Correlation) and Difference (One-Sample T-test). The result can be linked to what Collins and Mittag (2005) suggests that use of the (inferential) calculator needs to be explored further as a benefit for student-learning in an introductory statistics courses. According to Tarmizi, et al. (2008), the use of technology allows many more students to be actively engaged in cognitive process, demonstrating skills, and decision making. Further, they stressed that when technology is used as a tool in supplementing performance tasks of the students; the goals, decisions, and progress will be highly observable.

	Hypothesis Test in Procedure					
	Stating Null and	Computing	Giving	Making		
Selected topics in Inferential Statistics	Alternative	Test statistics	Decision to	Conclusions		
	Hypotheses		Но			
Pearson's Correlation	VS	Е	VS	VS		
Spearman's Correlation	VS	VS	VS	VS		
Linear Regression	VS	VS	VS	VS		
One-Sample T-test	VS	Е	VS	VS		
T-Test for Independent Samples	VS	VS	VS	VS		
(Assuming Unequal Variances)						
T-Test for Independent Samples (Assuming	VS	VS	VS	S		
Equal Variances)						
T-Test for Correlation Samples	VS	VS	VS	S		
One-Way Analysis of Variance	VS	VS	VS	S		
Two-Way Analysis of Variance	VS	VS	VS	S		

Table 2:-Competency of Students in Performing Selected Topics in Inferential Statistics

Satisfactory (S)- 80.00-84.99 Very Satisfactory (VS)- 85.00-89.99 Excellent (E) – 90.00-above

Conclusion:-

This study concluded that the utilization of Scientific Calculator in Teaching Selected Topics in Descriptive Statistics can improve the performance of the Students in basic statistical concepts which served as ladder in performing advanced statistical analyses. It is also concluded that in teaching Statistics, the utilization of modern technology helps achieve higher learning since it was found out that this output of technology helps students achieved the desired higher level of competency.

Literature Cited:-

- 1. Bersales, L.S., Reston, E. (2008). Reform Efforts in Training Statistics Teachers in the Philippines: Challenges and Prospects. Retrieved http://iaseweb.org/documents/papers/rt2008/T5P2_Reston.pdf
- 2. Boon, L. K., Yong, G. J., Han, C. T., &Gaik, T. K. (2009). The Effectiveness of Using Scientific Calculator in Solving Non-Linear Equations by Newton-Raphson Method.
- 3. Collins, L. B., & Mittag, K. C. (2005). Effect of calculator technology on student achievement in an introductory statistics course. Statistics Education Research Journal, 4(1), 7-15.
- 4. Jacob, J.R. (2012). Development and Validation of Module in Teaching Selected Topics in Geometry for Third Year Students at Santa Maria National High School S. Y. 2010-2011. Unpublished Research, Laguna State Polytechnic University, Siniloan, Laguna.
- 5. Indoshi, F.C., Ochanda, J. P. (2011). Challenges and Benefits of Using Scientific Calculators in the Teaching and Learning of Mathematics in Secondary School Education.Retrievedfrom http://www.academicjournals.org/article/article1380106834_Ochanda%20and%20Indoshi.pdf
- 6. Pedron, J. M. (2016). Utilization of Scientific Calculator in Teaching Selected Topics in Descriptive Statistics at Governor Felicisimo T. San Luis National Agro-Industrial High School S. Y. 2014-2015. Unpublished Research. Laguna State Polytechnic University, SIniloan, Laguna
- 7. Republic Act 10533. Enhanced Basic Education Act of 2013
- 8. Real, C. A. (2013). Graphing Calculator and its Effect on the Performance in Mathematics of Fourth Year High School Students in Famy National High School.Unpublished Research, Laguna State Polytechnic University, Siniloan, Laguna.
- 9. Tarmizi, R., Ayub, A., Abu Bakar, K., &Yunus, A. (2008). Instructional efficiency of utilization of autograph technology vs handheld graphing calculator for learning algebra.International Journal of Education and Information Technologies, 2(3), 184-193.