LEARNING AS ONE NATION

Expanded Project

Stat & Prob_19

SHS LEARNING ACTIVITY

Name: _____ **Score/Mark:** _____

Grade and Section: _____ **Date:** _____

Strand: ☐ STEM ☐ ABM ☐ HUMSS ☐ ICT (*TVL Track*)

Subject: ***Statistics & Probability***

Type of Activity: ☐ Concept Notes ☐ Skills: Exercise/Drill ☐ Illustration ☐ Performance Task ☐ Essay/Report ☐ Others: _____

Activity Title: Central Limit Theorem

Learning Target: To define the sampling distribution of the sample mean using the Central Limit Theorem.

References: *(Author, Title, Pages)*
1) Belecina, R.R., et al. "Statistics and Probability" 1st Ed., pp. 110-135;
2) L.A Sajulga, CVIF Learning Activities

The *standard deviation* of the sampling distribution of the sample mean, $\sigma_{\bar{X}}$, is also called the *standard error of the sample mean*. It is very useful since it measures the degree of accuracy of the sample mean ($\mu_{\bar{X}}$) as an estimate for the population mean ($\boldsymbol{\mu}$). The closer its value to zero, the better estimate we have for the parameter $\boldsymbol{\mu}$.

- $\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}}$, when population is infinite or sampling is with replacement
- $\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}}\left(\sqrt{\frac{N-n}{N-1}}\right)$, when the population is finite or sampling is without replacement

As we can observe, the value of $\sigma_{\bar{X}}$ depends on the value of the sample size n. Hence, to have a good estimate of the population mean, the value of n must be sufficiently large. This leads us to the theorem:

Central Limit Theorem

If random samples of size n are drawn from a population with mean μ and standard deviation σ, then as n becomes larger, the sampling distribution of the sample mean $\bar{X}$ approaches the normal distribution.

The sample size of $n = 30$ has been a guideline used in the Central Limit Theorem. As implied by the theorem, if $n \geq 30$, you will be able to have a good normal approximation for the sample mean $\bar{X}$. On the other hand, if $n < 30$ but the population is known to be normal, then the sampling distribution of $\bar{X}$ will still exactly follow a normal distribution.

Exercise:

1. How accurate is your estimate for the population if the standard deviation of the sampling distribution of the sample mean is:
   a) closer to zero?
   b) large?
2. Illustrate the Central Limit Theorem using a normal curve when n is small and when n is large. (Hint: The bigger the value of n, the smaller the variance of $\bar{X}$ gets.)