Unit D - *Inference*

Overview

Unit D deals with the reasoning of statistical inference. It presents methods for estimating and testing claims about a population proportion. Discussion about confidence intervals builds on foundations laid in previous learning about normal distributions and sampling. Extensions are made to testing for an association between two categorical variables, and estimating and testing claims about a population mean.

21st Century Capacities: Analyzing, Synthesizing

Stage 1 - Desired Results

ESTABLISHED GOALS/ STANDARDS

MP 1 Make sense sense of problems and persevere in solving them
MP3 Construct viable arguments and critique the reasoning of others
MP5 Use appropriate tools strategically
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CCSS.MATH.CONTENT.HSS.MD.B.7
(+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

Transfer:

Students will be able to independently use their learning in new situations to...

1. Model relationships among quantities. (Analyzing)
2. Make sense of a problem, initiate a plan, execute it, and evaluate the reasonableness of the solution. (Analyzing)
3. Apply familiar mathematical concepts to a new problem or apply a new concept to rework a familiar problem. (Synthesizing)
4. Justify reasoning using clear and appropriate mathematical language.

Meaning:

UNDERSTANDINGS: *Students will understand that:*

1. Mathematicians identify relevant tools, strategies, relationships, and/or information in order to draw conclusions.
2. Mathematicians create or use models to examine, describe, solve and/or make predictions.
3. Mathematicians select and use appropriate statistical methods and tools to analyze data, show trends,evaluate inference and/or describe or make predictions.
4. Mathematicians analyze data to evaluate inferences, make predictions and/or communicate a decision.

ESSENTIAL QUESTIONS: Students will explore & address these recurring questions:

A. What beliefs are worth testing scientifically?
B. As consumers of information, how do we question the information we are presented as facts?
C. How is inference used to shape our world?

	Acquisition:	
	Students will know… 1. Statistical inference draws conclusions about a population based on data from a sample 2. Parameters describe the population 3. Statistics estimate the parameter based on a sample 4. If the sample is large enough: the sampling distribution of p is approximately normal, the mean of the sampling distribution is p, the formula for standard deviation of a sampling distribution 5. As we increase the number of samples, the distribution becomes normal, and 95% of samples approach the true parameter. 6. Significance tests assess the evidence provided by data about some claim concerning a population. 7. Significance tests try to prove that a claim is so unlikely to be true that it must not be true. 8. The smaller the P-value is, the stronger is the evidence against H0 provided the data. 9. If the P-value is smaller than a (alpha), we say that the data are statistically significant. 10. Significant does not mean important, it means not likely to happen by chance. 11. A significance test answers only 1 question: How strong is the evidence that the null hypothesis is not true? 12. The P-value of a significance test depends strongly on the size of the sample, as well as on the truth about the population. 13. There is no sharp border between "significant" and "insignificant," only increasingly strong evidence as the P-value decreases. 14. 95% confidence interval is guaranteed to capture the true population parameter in 95% of all samples 15. The sampling distribution of a statistic is the distribution of values taken by the statistic in all possible samples of the same size from the same population 16. Confidence interval for a parameter has two parts: an interval calculated from the data and a confidence level C which gives the probability that the interval will capture the true parameter value in repeated samples.	*Students will be skilled at…* 1. Identifying topics that can be tested with inference 2. Creating null and alternate hypotheses 3. Creating a random sample 4. Calculating a sample parameter 5. Calculating a standard deviation 6. Drawing P-values on a normal curve 7. Stating a 95% confidence interval as a confidence statement 8. Calculating and interpreting P-values at various degrees of confidence 9. Making a statement about the outcomes of hypothesis tests in the context of an experiment

	17. To create survey results with a desired margin of error, like ± 3 pts for gallup polls, solve for the margin of error algebraically. 18. The null hypothesis (H0 pronounced h-nought), is the claim which you will try to disprove 19. The alternate hypothesis (HA), is the claim you will support by disproving H0. 20. The probability, computed assuming that H0 is true, that the sample outcome would be as extreme or more extreme than the actually observed outcome is called the P-value of the test. 21. Good data is the foundation of good research 22. Questionable data creates weakness in any inference 23. Randomness of data sources must be addressed 24. Bias must be eliminated from samples and surveys 25. Confidence intervals estimate the unknown value of a parameter and also tell us how uncertain the estimate is, and * Even 99% confidence leaves 1% room for a false negative * High confidence comes at the cost of a wider confidence interval * If you want a higher confidence level and lower interval range, increase sample size. 26. Our methods require that the proportion (p) is significantly larger than the sample and that the sample is large enough so that the distribution of the sample proportion is close to normal 27. Always report a P-value with the sample size and statistics about the sample outcome. 28. Vocabulary: statistical inference, confidence interval, confidence level, sampling distribution, critical values, significance test, P-value, null hypothesis, alternative hypothesis, statistically significance at the 5% level	