*Unit 4- Inference

Content Area: **Mathematics**
Course(s):
Time Period: **February**
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Enduring Understandings

Hypothesis testing uses sample data to decide between two competing claims about a population characteristic.

Statistically significant results mean that the sample data is unlikely to occur if the claimed population paprameter is true.

A Type I or Type II error can naturally occur when conducting a hypothesis test because of the randomization portion in the data collection process.

Inference testing is based on the principles of using sampling distributions to calculate probability of a sample statistic occuring in a distribution of a population paramenter.

Essential Questions

Why do we use hypothesis tests?

What do statistically significant inference test results mean?

What considerations need to be accounted for when reporting the results of a test?

What other statistical ideas are the foundations behind the logic of hypothesis tests?

Content

Topics Addressed:

Confidence Intervals: The Basics

Estimating a Population Proportion

Estimating a Population Mean

Significance Tests: The Basics

Tests about a Population Proportion

Tests about a Population Mean

Chi-Square Tests for Goodness of Fit

Inference for Two Way Tables

Skills

Confidence Intervals- The Basics:

Determine the point estimate and margin of error from a confidence interval.

Interpret a confidence interval in context.

Interpret a confidence level in context.

Describe how the sample size and confidence level affect the length of a confidence interval.

Explain how practical issues like nonresponse, undercoverage, and response bias can affect the interpretation of a confidence interval.

Estimating a Population Proportion:

State and check the Random, 10%, and Large Counts conditions for constructing a confidence interval for a population proportion.

Determine critical values for calculating a C% confidence interval for a population proportion using a table or technology.

Construct and interpret a confidence interval for a population proportion.

Determine the sample size required to obtain a C% confidence interval for a population proportion with a specified margin of error.

Estimating a Population Mean:

State and check the Random, 10%, and Normal/Large Sample conditions for constructing a confidence interval for a population mean.

Explain how the t distributions are different from the standard Normal distribution and why it is necessary to use a t distribution when calculating a confidence interval for a population mean.

Determine critical values for calculating a C% confidence interval for a population mean using a table or technology.

Construct and interpret a confidence interval for a population mean.

Determine the sample size required to obtain a C% confidence interval for a population mean with a specified

margin of error.

Significance Tests- The Basics:

State the null and alternative hypotheses for a significance test about a population parameter.

Interpret a P-value in context.

Determine if the results of a study are statistically significant and draw an appropriate conclusion using a significance level.

Interpret a Type I and a Type II error in context, and give a consequence of each.

Tests about a Population Proportion:

State and check the Random, 10%, and Large Counts conditions for performing a significance test about a population proportion.

Perform a significance test about a population proportion.

Interpret the power of a test and describe what factors affect the power of a test.

Describe the relationship among the probability of a Type I error (significance level), the probability of a Type II error, and the power of a test.

Tests about a Population Mean:

State and check the Random, 10%, and Normal/Large Sample conditions for performing a significance test about a population mean.

Perform a significance test about a population mean.

Use a confidence interval to draw a conclusion for a two-sided test about a population parameter.

Perform a significance test about a mean difference using paired data.

Chi-Square Tests for Goodness of Fit:

State appropriate hypotheses and compute expected counts for a chi-square test for goodness of fit.

Calculate the chi-square statistic, degrees of freedom, and P-value for a chi-square test for goodness of fit.

Perform a chi-square test for goodness of fit.

Conduct a follow-up analysis when the results of a chi-square test are statistically significant.

Inference for Two Way Tables:

Compare conditional distributions for data in a two-way table.

State appropriate hypotheses and compute expected counts for a chi-square test based on data in a two-way table.

Calculate the chi-square statistic, degrees of freedom, and P-value for a chi-square test based on data in a two-way table.

Perform a chi-square test for homogeneity.

Perform a chi-square test for independence.

Choose the appropriate chi-square test.

Resources

Rossman-Chance Applet Collection

StatsMonkey

Rice Virtual Lab in Statistics

Khan Academy Mission: AP Statistics

Standards

NJSLS 2016

Statistics and Probability

MAKING INFERENCES AND JUSTIFYING CONCLUSIONS

A. Understand and evaluate random processes underlying statistical experiments

1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population

Mathematics | Standards for Mathematical Practice

2 Reason abstractly and quantitatively.

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

4 Model with mathematics.

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

5 Use appropriate tools strategically.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.