Probability and Statistics

2014-2015

Chris Foley cfoley@lrhsd.org ext. 8465

Maureen McMichael mmcmichael@lrhsd.org ext. 8367

Mike Spera mspera@lrhsd.org ext. 8340

Unit 5: Inferential Statistics

Students will be able to independently use their learning to make conclusions when given one or two data set(s).

Stage 1 – Desired Results

Established Goals

2009 NJCCC Standard(s), Strand(s)/CPI #
(http://www.nj.gov/education/cccs/2009/final.htm)

Common Core Curriculum Standards for Math and English
(http://www.corestandards.org/)

Making Inferences and Justifying Conclusions S.IC: # 1

Understand and evaluate random processes underlying statistical experiments

Making Inferences and Justifying Conclusions S.IC: # 4 - 6

Make inferences and justify conclusions from sample surveys, experiments, and observational studies

21st Century Themes
(www.21stcenturyskills.org)

___ Global Awareness
_x__Financial, Economic, Business and Entrepreneurial Literacy
___Civic Literacy
___Health Literacy
___Environmental Literacy

21st Century Skills

Learning and Innovation Skills:
_x__Creativity and Innovation
_x__Critical Thinking and Problem Solving
_x__Communication and Collaboration

Information, Media and Technology Skills:
___Information Literacy
___Media Literacy
_x__ICT (Information, Communications and Technology) Literacy

	Life and Career Skills: _x__Flexibility and Adaptability _x__Initiative and Self-Direction ___Social and Cross-Cultural Skills _x__Productivity and Accountability _x__Leadership and Responsibility
Enduring Understandings: *Students will understand that . . .* *EU 1* Statistics can be used to test claims and make inferences about a population parameter. *EU 2* Statistics can be used to test claims and make inferences about two population parameters.	**Essential Questions:** *EU 1* • How can hypothesis testing be used to draw conclusions based on a single sampled scenario? • What is the importance of each step in hypothesis testing? • How can confidence intervals be used draw conclusions based on a single sampled scenario? • How is the width of the interval influenced by given information? *EU 2* • How can hypothesis testing be used to draw conclusions based on a two sampled scenario? • What are the differences in hypothesis testing for one sample or two samples? • What is the importance of the number zero in regards to a two sampled confidence interval? • How can confidence intervals be used to draw conclusions based on a two sampled scenario

Knowledge: *Students will know . . .*	**Skills:** *Students will be able to . . .*
EU 1 • that each of the steps in hypothesis testing are necessary • which type of test to conduct when given certain information. • which type of confidence interval to construct when given certain information. • that the sample statistic and margin of error create the confidence interval. *EU 2* • which type of test to conduct when given certain information. • the difference between testing for a mean and testing for a proportion. • which type of confidence interval to construct when given certain information. • what effect the signs of the limits an interval have on the difference between population parameters	*EU 1* • identify relevant information from a problem • use the relevant information to identify which type of test to conduct or confidence interval to construct • state and complete the five steps in a single sample hypothesis test • construct and interpret the meaning of a confidence interval for a single sampled scenario • determine sample mean and margin of error when given a confidence interval *EU 4* • identify relevant information from a problem • use the relevant information to identify which type of test to conduct or confidence interval to construct • state and complete the five steps in a two sampled hypothesis test • construct and interpret the meaning of a confidence interval for a two sampled scenario

Stage 2 – Assessment Evidence

Recommended Performance Tasks:

_

Other Recommended Evidence: *Tests, Quizzes, Prompts, Self-assessment, Observations, Dialogues, etc.*

Assessments to include:

- confidence intervals and hypothesis tests for one sampled means
- confidence intervals and hypothesis tests for one sampled proportions
- minimum sample size needed for confidence intervals of means and proportions
- confidence intervals and hypothesis tests for two sampled means
- confidence intervals and hypothesis tests for two sampled proportions

- Cumulative One Sampled Inference Assessment
- Cumulative Two Sampled Inference assessment

- Assessed elements from the performance task

- Other teacher-graded evaluations

Stage 3 – Learning Plan

Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections: *Consider the WHERETO elements. Each learning activity listed must be accompanied by a learning goal of A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer.*

- Ti-Nspire activity #1 – Cancer clusters
- http://education.ti.com/en/us/activity/detail?id=4C646C62F7DB40A5AF097D4F8D589123&ref=/en/us/activity/search/subject?d=F988B132B1A74080AC6C1D0A68C5E3BB&s=B843CE852FC5447C8DD88F6D1020EC61&sa=44D0E51546AF420EA579740D43F22FC7&t=DD50003848CE4396B7D67AA81795D343

- Sports Drink Activity

  As the new head coach for a sports team, one of the first decisions is to choose the sports drink to be used during games and practices. An article in *Sports Report* magazine contained statistical background of possible selected sports drinks. The following table lists the most popular sports drinks and some important information about each of them.

Drink	Calories	Sugar	Sodium	Carbohydrates
1. All Sport	150	40g	140mg	40g
2. CLIF Quench	45	10g	130mg	11g
3. Gatorade G Series 02 Performance	50	14g	110mg	18g
4. Gatorade G Series 02 Performance G2	20	5g	110mg	5g
5. Gatorade G Series 03 Recover	110	20g	105mg	20g
6. Glaceau Vitamin Water	50	13g	0mg	13g

- Would this be considered a small sample?
- Create a 90% confidence interval about each mean for all four variables(calories, sugar, sodium, carbohydrates). Identify which products fall inside and outside the confidence interval for each variable.
- Are there any you would consider outliers?
- How many degrees of freedom are there?
- From your calculations, is there a major factor influencing your decision?
- List which drink you would recommend and why. Using your calculations, support your decision.

(Data was obtained from Findthebest.com)

- Car Theft Activity

  You recently received a job with a company that manufactures an automobile antitheft device. To conduct an advertising campaign for the product, you need to make a claim about the number of auto thefts per year. Since the population of various cities in the US varies, you decide to use rates per 10,000 people. Your boss said that last year the theft rate per 10,000 people was 44 vehicles. You want to see if it has changed. The following are rates per 10,000 people for 36 randomly selected locations in the United States.

  55 42 125 62 134 73 39 69 23 94 73 24 51 55 26 66 41 67

  15 53 56 91 20 78 70 25 62 115 17 36 58 56 33 75 20 16

  source: National Insurance Crime Bureau

a) What hypothesis would you use?
b) Is the sample considered small or large?
c) What assumption must be met before the hypothesis test can be conducted?
d) Would your select a one- or two-tailed test? Why?
e) What critical value(s) would you use?
f) Conduct a hypothesis test using a 5% level of significance. Use $\sigma = 30.3$
g) Summarize your decision.
h) If you lived in a city whose population was about 50,000, how many auto thefts per year would you expect to occur?

Critical Vocabulary:

- **confidence interval**
- **confidence level**
- **point estimate**
- **degrees of freedom**
- **margin of error**
- **proportion**
- **null and alternative hypotheses**
- **critical value**
- **p-value**
- **level of significance**
- **test statistic**
- **z test**
- **t test**
- **claim**

The following are the suggested learning activities in a logical sequence.

Approximate timeline: 45 days

Students will be able to:

- **find and interpret the confidence interval for the mean when the population standard deviation is known (T)**
- **understand the definitions and five steps used in hypothesis testing (M)**
- **conduct a hypothesis test to test a mean when the population standard deviation is known using the z test (T)**
- **find and interpret the confidence interval for the mean when the population standard deviation is unknown (T)**
- **Sports drink activity (T)**
- **conduct a hypothesis test to test a mean when the population standard deviation is unknown using the t test (T)**
- **determine the minimum sample size for finding the a confidence interval for the mean (M)**
- **find and interpret the confidence interval for a proportion (T)**
- **conduct a hypothesis test to test proportions using the z test (T)**
- **determine the minimum sample size for finding a confidence interval for a proportion (M)**
- **conduct a hypothesis test to test the difference between sample means when the population standard deviation is known, using the z test (T)**
- **Car Theft activity (T)**
- **find and interpret the confidence interval for the difference between two means when the population standard deviation is known (T)**

- **conduct a hypothesis test to test the difference between two means for independent and dependent samples, using the t test (T)**
- **find and interpret the confidence interval for the difference between two means of independent and dependent samples when the population standard deviation is unknown (T)**
- **conduct a hypothesis test to test the difference between two proportions (T)**
- **Ti-Nspire activity #1 – Cancer Clusters (T)**
- **Find and interpret the confidence interval for the difference between two proportions (T)**