Applied Statistics

Domain	**Probability and Informed Decisions**	
Cluster	**Use probability to evaluate outcomes and make decisions.**	
Standard(s)	M.ASHS.23	Interpret results from a randomized experiment comparing two treatments. Use simulations to decide if experimental results are significant. Instructional Note: Develop informally the comparison of an observed result and an established probability value (for example $p \leq 0.05$).

Content Examples:

- Simple Hypothesis Testing: *https://www.youtube.com/watch?v=5D1gV37bKXY*
- Idea Behind Hypothesis Testing: *https://www.youtube.com/watch?v=dpGmVV0-4jc*

Relevant Content:

Vocabulary:

- Alternative Hypothesis: The alternative hypothesis is the claim we are trying to find evidence for in a significance test.
- Comparison: Comparison is an experiment design principle that uses a design that compares two or more treatments.
- Completely Randomized Design: A completely randomized design is a design in which the experimental units are assigned to the treatments completely by chance.
- Confounding: When two variables are associated in such a way that their effects on a response variable cannot be distinguished from each other.
- Inference: Inference is when we draw conclusions that go beyond the data at hand.
- Null Hypothesis: The null hypothesis is the claim we weigh evidence against in a significance test. Often, the null hypothesis is a statement of "no difference".
- Quantitative Variable: A quantitative variable is a variable that takes numerical values that are quantities – counts or measurements.
- Response Variable: A response variable is a variable that measures an outcome of a study.
- Sampling Variability: Sampling variability involves the principle that different random samples of the same size from the same population produce different estimates.
- Simulation: A simulation is an imitation of chance behavior, based on a model that accurately reflects the situation.

» Statistically Significant: When the observed results of a study are too unusual to be explained by chance alone, the results are called statistically significant. If the P-value is smaller than alpha, we say that the results of a statistical study are significant at level, a. In that case, we reject the null hypothesis and conclude that there is convincing evidence in favor of the alternative hypothesis.

» Treatment: A treatment is a specific condition applied to the individuals in an experiment. If an experiment has several explanatory variables, a treatment is a combination of specific values of these variables.

Assessment Links or Tasks:

» Is Anchored Putting Better? Activity
https://261d9fb9-63bc-4936-a892-1fe3dbcf2042.filesusr.com/ugd/4c04a2_3cb492d8db3c4601bb28af9c0a8a6f38.pdf
Is Anchored Putting Better? Answer Key
https://261d9fb9-63bc-4936-a892-1fe3dbcf2042.filesusr.com/ugd/4c04a2_e1cd785d3e134fe9a773754cb8081285.pdf
See the following instructions: *Inferences for Experiments Lesson Plan*

» How to Experiment Well Activity
https://261d9fb9-63bc-4936-a892-1fe3dbcf2042.filesusr.com/ugd/4c04a2_2d9b93dba4f94b72b737bd38339ad32e.pdf
How to Experiment Well Answer Key
https://261d9fb9-63bc-4936-a892-1fe3dbcf2042.filesusr.com/ugd/4c04a2_2459f76d08db45658f1379c76e1694dd.pdf
See the following instructions: *How to Experiment Well Lesson Plan*

Inference for Experiments Lesson Plan

Learning Targets

(1) Outline an experiment that uses a completely randomized design.

(2) Explain the concept of statistical significance in the context of an experiment.

(3) Use simulation to determine if the difference between two means or two proportions in an experiment is significant.

How to Experiment Well Lesson Plan

Learning Targets

(1) Describe how to randomly assign treatments using slips of paper or technology.

(2) Explain the purpose of random assignment in an experiment.

(3) Identify other sources of variability in an experiment and explain the benefits of keeping these variables the same for all experimental units.