Course: Probability and Statistics **Unit 4:** Two-Sample Inferential Statistics	**Year of Implementation:** 2026-2027

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Stage One - Desired Results

Link(s) to New Jersey Student Learning Standards for this course:
https://www.state.nj.us/education/cccs/2020/

- **Unit Standards:**
  - ***Content Standards***
    - https://www.nj.gov/education/standards/math/

NJSLS - Making Inferences and Justifying Conclusions [S-IC]

- S-IC.B.5 – Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

  - ***2020 NJSL Standards: Career Readiness, Life Literacies, and Key Skills Introduction***
    https://www.nj.gov/education/standards/clicks/Docs/2020NJSLS-CLKS.pdf

    - 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions
    - 9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience.
    - 9.4.12.CI.1 – Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
    - 9.1.12.FI.3 – Develop a plan that uses the services of various financial institutions to prepare for long term personal and family goals (e.g., college, retirement).
    - 9.4.12.CT.2 – Explain the potential benefits of collaborating to enhance critical thinking and problem solving.

- ***Interdisciplinary Content Standards***
  Computer Science and Design Thinking Introduction
  https://www.nj.gov/education/standards/compsci/Docs/2020%20NJSLS-CSDT.pdf
  - 8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.

- ***NJ Statutes:*** NJ State law mandates the inclusion of the following topics in lesson design and instruction as aligned to elementary and secondary curriculum.

  Amistad Law: N.J.S.A. 18A 52:16A-88 Every board of education shall incorporate the information regarding the contributions of African-Americans to our country in an appropriate place in the curriculum of elementary and secondary school students.

  Holocaust Law: N.J.S.A. 18A:35-28 Every board of education shall include instruction on the Holocaust and genocides in an appropriate place in the curriculum of all elementary and secondary school pupils. The instruction shall further emphasize the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens.

  LGBT and Disabilities Law: N.J.S.A. 18A:35-4.35 A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards (N.J.S.A.18A:35-4.36) A board of education shall have policies and procedures in place pertaining to the selection of instructional materials to implement the requirements of N.J.S.A. 18A:35-4.35.

  Diversity and Inclusion (N.J.S.A. 18A:35-4.36a) A board of education shall incorporate instruction on diversity and inclusion in an appropriate place in the curriculum of students in grades kindergarten through 12 as part of the district's implementation of the New Jersey Student Learning Standards.

Asian American and Pacific Islanders (AAPI) P.L.2021, c.410 Ensures that the contributions, history, and heritage of Asian Americans and Pacific Islanders (AAPI) are included in the New Jersey Student Learning Standards (NJSLS) for Social Studies in kindergarten through Grade 12 (P.L.2021, c.416)

For additional information, see

NJ Amistad Curriculum: ***https://www.nj.gov/education/amistad/about/***

Diversity and Inclusion: ***https://www.nj.gov/education/standards/dei/index.shtml***

- *(Sample Activities/ Lessons):* ***https://www.nj.gov/education/standards/dei/samples/index.shtml***

Asian American and Pacific Islanders:

- ***Asian American and Pacific Islander Heritage and History in the U.S.***
  A Teacher's Guide from EDSITEment offering a collection of lessons and resources for K-12 social studies, literature and arts classrooms that center around the experiences, achievements and perspectives of Asian Americans and Pacific Islanders across U.S. history.

Transfer Goal: Students will be able to independently use their learning to test claims that compare multiple groups and communicate conclusions in decision-making context.

As aligned with LRHSD Long Term Learning Goal(s): https://www.lrhsd.org/academics/curriculum

The Lenape Regional High School District Math program, in alignment with the New Jersey Student Learning Standards for Mathematics, prepares our students for success in college and their careers. Through completing our coursework, our students will be better able to:

1. Problem-Solving: apply and transfer autonomously and collaboratively mathematical concepts and problem- solving techniques to unfamiliar, varied and real-world situations
2. Reasoning: reason abstractly and quantitatively by applying mathematical representations, symbols and estimation techniques when engaging in problem-solving
3. Critical Thinking: construct and effectively communicate valid conclusions and critique the reasoning of others
4. Modeling: demonstrate mastery of concepts by evaluating models that others have constructed or by creating appropriate models of their own

5. Tools: identify the correct tools to solve problems, if applicable
6. Precision: determine an answer's appropriateness as a means of determining its validity, while using proper mathematical notation and units
7. Structure: use multiple representations, critical thinking skills, and prior knowledge to solve problems in new situations
8. Patterns: analyze data and recognize patterns in a variety of situations
9. Habits of Mind: approach new situations with curiosity, persistence, resourcefulness, and confidence; take risks, monitor their progress, accept and learn from setbacks, make adjustments, and reflect on their performance.

Enduring Understandings	Essential Questions
Students will understand that. . . *EU 1* comparing two populations allows us to determine whether observed differences are statistically significant or more likely due to chance.	● How can we conduct appropriate hypothesis tests that determine the significance of differences or relationships between populations?
Knowledge Students will know . . . *EU 1* ● different tests for comparing two means are used depending on whether the population standard deviation is known. (S-IC.B.5,9.4.12.IML.3) ● a paired (dependent) sample t-test is used when two related measurements are taken from the same group or matched pairs. (S-IC.B.5) ● the z-test for the difference between two proportions is used when conditions for normal approximation are met. (S-IC.B.5, 9.4.12.CI.1) ● interpretation of hypothesis test results must be in context, including an understanding of p-values, test	**Skills** Students will be able to. . . *EU 1* ● identify when to use a z-test or t-test to compare two means based on whether population standard deviations are known and whether samples are independent or dependent. (S-IC.B.5) ● analyze a hypothesis test for the difference between two independent means using both z and t distributions. (S-IC.B.5, 9.4.12.IML.3, 9.4.12.IML.3) ● construct a hypothesis test for the difference between two dependent (paired) means using a paired t-test. (S-IC.B.5)

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<tr>
<td>statistics, and types of error. (S-IC.B.5, 9.4.12.IML.4m 9.4.12.IML.3)
● different chi-square tests are used to test for relationships between populations (S-IC.B.5, 8.1.12.DA.5)
● in one-way ANOVA, differences among three or more group means are compared. (S-IC.B.5)
● interpretations of chi-square and ANOVA results require contextual understanding of test assumptions, p-values, and degrees of freedom. (S-IC.B.5, 9.4.12.IML.4)</td>
<td>● generate a hypothesis test for the difference between two proportions using the z-test for proportions. (S-IC.B.5, 9.4.12.CI.1)
● interpret the results of two-sample hypothesis tests in the context of the problem, including the meaning of p-values, statistical significance, and real-world implications. (S-IC.B.5, 9.4.12.IML.4)
● formulate a chi-square goodness-of-fit test. (S-IC.B.5, 8.1.12.DA.5)
● develop a chi-square test of independence on a contingency table to evaluate variable relationships. (S-IC.B.5)
● conduct a chi-square test of homogeneity across groups to compare proportions. (S-IC.B.5)
● execute one-way ANOVA to compare means for three or more independent samples. (S-IC.B.5)</td>
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<tr>
<td colspan="2">Stage Two - Assessment</td>
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<td colspan="2"><u>Other Evidence:</u>
● Classroom Summarizers
● Independent Practice
● Self Assessments
● Classroom Assessments</td>
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<td colspan="2">Stage Three - Instruction</td>
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Learning Plan: **Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections: 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.** *{place A, M and/or T along with the applicable EU number in parentheses after each statement} All knowledge and skills must be addressed in this section with a corresponding lesson/activity which teaches each concept. The following color codes are used to notate activities that correspond with interdisciplinary connections and 21st Century Life & Career Connections (which involves Technology Literacy): Red = Interdisciplinary Connection; Purple = 21st Century Life & Career Connection*

- Double Stuff Oreos vs. Regular Activity - Inference: Two Sample T-Test (A, T, EU 1)
- Diagnosis Lab Activity - Chi-Square Goodness of Fit Test (M, EU 1)
- Will You Get Accepted to College? Activity - Inference Chi-Square Test Homogeneity (M, EU 1)

Suggested Sequence of Learning Activities

- Classify scenarios and identify appropriate test types (independent/dependent, mean/proportion, z/t). (A, M EU 1)
- Conduct z-test comparing two means (σ known). (T, EU 1)
- Conduct independent-samples t-test when σ unknown. (T, EU 1)
- Double Stuff Oreos vs. Regular Activity - Inference: Two Sample T-Test (A, T, EU 1)
- Conduct z-test comparing two proportions. (T, EU 1)
- Conduct paired-samples t-test for mean differences. (T, EU 1)
- Construct confidence intervals for differences between two means/proportions and interpret results. (A, EU 1)
- Compare confidence intervals with hypothesis test outcomes to reinforce inferential connections. (M, EU 1)
- Introduce chi-square goodness-of-fit concepts (A, EU 1)
- Perform chi-square goodness-of-fit test (A, M EU 1).
- Diagnosis Lab Activity - Chi-Square Goodness of Fit Test (M, EU 1)
- Perform Chi-Square Test for Independence (M, T, EU 1)
- Perform Chi-Square Test for Homogeneity of Proportions (M, T, EU 1)
- Will You Get Accepted to College? Activity - Inference Chi-Square Test Homogeneity (M, EU 1)
- Perform One-Way ANOVA (T, EU 1)

Pacing Guide

Unit #	*Title of Unit*	*Approximate # of teaching days*
1	Collect, Model, and Analyze Date	48
2	Probability	53
3	One - Sample Inferential Statistics	21
4	Two - Sample Inferential Statistics	13

Instructional Materials

- *TI-Nspire*
- *Desmos*
- *https://www.amstat.org/whats-going-on-in-this-graph*
- *https://slowrevealgraphs.com/*
- *Math Medic*

Accommodations

Special Education: The curriculum will be modified as per the Individualized Education Plan (IEP). Students will be accommodated based on specific accommodations listed in the IEP.

Students with 504 Plans: Students will be accommodated based on specific accommodations listed in the 504 Plan.

English Language Learners: Students will be accommodated based on individual need and in consultation with the ELL teacher.

Students at Risk of School Failure: Students will be accommodated based on individual need and provided various structural supports through their school.

Gifted and Talented Students: Students will be challenged to enhance their knowledge and skills through acceleration and additional independent research on the subject matter.