



artsNOW

DATA TAKES FLIGHT: STATISTICAL REASONING AND VISUAL ARTS

Grade Band: 9-12

Content Focus: Visual Arts & Math



LEARNING DESCRIPTION

In this arts-integrated lesson, students combine visual art and statistical reasoning to explore the performance of paper airplane designs. Inspired by artists who create large-scale aircraft sculptures, students build and test various paper airplanes—both standard and original creations—while collecting flight distance data. They apply statistical methods such as measures of center and spread, confidence intervals, and hypothesis testing to evaluate which designs perform best. This lesson encourages creativity, critical thinking, and real-world application of statistical concepts through hands-on experimentation and artistic design.

LEARNING TARGETS

Essential Questions	"I Can" Statements
How can data collection and analysis help us evaluate the effectiveness of different airplane designs?	I can design and implement a plan to collect consistent and reliable data. I can calculate and interpret mean, five-number summary, standard deviation, and confidence intervals.

<p>In what ways can artistic choices, such as scale and form, influence the design and performance of a paper airplane?</p> <p>How can we use statistical reasoning to draw meaningful conclusions from experimental results?</p> <p>What role does creative design play in solving real-world problems using data?</p>	<p>I can conduct a hypothesis test to determine if the difference between airplane designs is statistically significant.</p> <p>I can use visual models (dot plots, box plots, etc.) to represent and analyze data.</p> <p>I can apply elements and principals of visual art—such as scale, shape, and form—in the design of functional paper airplanes.</p> <p>I can analyze and draw inspiration from artists who create large-scale or conceptual flight-themed works.</p> <p>I can explain how artistic and design choices impact both the aesthetic and function of my airplane.</p> <p>I can communicate the connection between my design process and the data I collected.</p>
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GEORGIA STANDARDS

Curriculum Standards	Arts Standards
<p>Statistical Reasoning: SR.MP Display perseverance and patience in problem-solving. Demonstrate skills and strategies needed to succeed in mathematics, including critical thinking, reasoning, and effective collaboration and expression. Seek help and apply feedback. Set and monitor goals.</p> <p>SR.MM.1 Apply mathematics to real-life situations; model real-life phenomena using mathematics.</p> <p>SR.DSR.3 Collect data by designing and implementing a plan to address the formulated statistical investigative question.</p> <p>SR.DSR.4 Analyze data by selecting and using appropriate graphical and numerical methods.</p> <p>SR.DSR.5 Interpret the results of the analysis, making connections to the formulated statistical investigative question.</p>	<p>VAHSVA.CR.1 Visualize and generate ideas for creating works of art.</p> <p>VAHSVA.CR.1.b Consider multiple options, weighing consequences, and assessing results.</p> <p>VAHSVA.CR.1.c Practice the artistic process by researching, brainstorming, and planning to create works of art.</p> <p>VAHSVA.CR.4.d Create three-dimensional works of art that incorporate a variety of sculptural methods/materials and demonstrate an understanding of relief sculpture and sculpture in the round from a variety of materials (e.g. clay, paper, plaster, wood).</p>

SOUTH CAROLINA STANDARDS

Curriculum Standards	Arts Standards
<p>Statistical Modeling: SM.DPSR.1.4 Construct and compare confidence intervals of different models to make conclusions about reliability given a margin of error.</p> <p>MPS.C.1 Demonstrate a deep and flexible conceptual understanding of mathematical ideas, operations, and relationships while making real-world connections.</p> <p>SM.DPSR.3.1 Apply an appropriate data-collection plan when collecting data for the investigative statistical question of interest.</p>	<p>Anchor Standard 1: I can use the elements and principles of art to create artwork.</p> <p>Anchor Standard 2: I can use different materials, techniques, and processes to make art.</p> <p>Anchor Standard 4: I can organize work for presentation and documentation to reflect specific content, ideas, skills, and or media.</p> <p>Anchor Standard 7: I can relate visual arts ideas to other arts disciplines, content areas, and careers.</p>

KEY VOCABULARY

Content Vocabulary	Arts Vocabulary
<ul style="list-style-type: none"> • <u>Data</u> - A collection of facts, measurements, or observations gathered for analysis • <u>Mean</u> - The mean, or arithmetic average, is calculated by summing all data points and dividing by the number of data points. It represents the center of data distributions. • <u>Five-number summary</u> - Consists of the minimum, first quartile (Q1), median (Q2), third quartile (Q3), and maximum. These values provide a concise summary of a data set's distribution. • <u>Standard deviation</u> - Measures the average distance of each data point from the mean. A higher standard deviation indicates greater variability in the data. • <u>Confidence intervals</u> - A range of values, derived from sample data, that is likely to contain the value of an unknown population parameter. The interval has an associated confidence level that quantifies the level of confidence that the parameter lies within the interval. 	<ul style="list-style-type: none"> • <u>Line</u> - A continuous mark made on some surface by a moving point. It may be two dimensional, like a pencil mark on a paper or it may be three dimensional (wire) or implied (the edge of a shape or form) often it is an outline, contour or silhouette. • <u>Shape</u> - A flat, enclosed line that is always two-dimensional and can be either geometric or organic • <u>Form</u> - An object that is three-dimensional and encloses volume (cubes, spheres, and cylinders are examples of various forms) • <u>Proportion</u> - The size relationships between different parts of an artwork. It determines how each element relates to the others in terms of size, scale, and placement.

MATERIALS

- Projector or means to project images of artwork and example data
- Links to information about artists and examples of work:
 - Links about Nancy Rubins:
<https://gagosian.com/exhibitions/2001/nancy-rubins-chas-stainless-steel/>
<https://www.publicartinpublicplaces.info/airplane-parts-2002-by-nancy-rubins>
 - Links about Berndnaut:
<https://www.berndnaut.nl/>
<https://www.ronchinigallery.com/artists/berndnaut-smilde/>
 - Links about David Cerny:
<https://davidcerny.cz/>
<https://www.hohmann.art/cerny>
 - Links about Rauschenberg:
<https://www.rauschenbergfoundation.org/art/artwork/glider>
<https://www.menil.org/collection/objects/8063-glider>
- Copy paper
- Poster board
- Paperclips
- Materials to decorate/create planes such as scissors, crayons, markers, etc.

INSTRUCTIONAL DESIGN

Opening/Activating Strategy

- Ask students, “What makes something ‘fly’ in both a literal and artistic sense?”. Have students answer on Padlet, poster, sticky note, Chalk Talk, etc.
- Explore Nancy Rubins’ use of airplane parts to create massive sculptural works.
 - Ask students what shapes, lines, and forms they see in the sculpture.
 - Ask students how scale or proportion change the impact of the work.
 - If desired, explore other related artists:
 - Berndnaut Smilde – Explores large-scale atmospheric installation
 - David Cerny – Conceptual artist that created oversized aircraft sculptures in public spaces.
 - Rauschenberg – “Glider” series combines flight imagery and large mixed-media works.
- Ask students probing questions such as:
 - How did these artists use “flight” in their works?
 - How does scale change the impact?
 - What message might the artists be sending using aircraft imagery?

Work Session

- Teach/review basic airplane types: traditional glider and dart.
 - Ask students to make observations about the shapes, lines, and forms that they see in each type of plane.
- Students create two standard planes (one glider, one dart) out of copy paper.
- Students create a third choice option that can be supersized using a poster board.
 - Encourage students to be creative with their designs and to think about shape and form as they design.
 - Refer them back to the artists’ work explored earlier and ask how their works could influence their plane designs.

- Once students have created their planes, they should hypothesize which plane will perform the best (teacher can choose the criteria – flies farthest, etc.).
- Conduct test flights for each plane (ten flights per plane) and record the distance flown in a table.
- Students discuss their observations about which design flew best.
- Students reflect on the following questions: What variables might be influencing the flight? How can I make adjustments for better flights?
- *Additional variation: Students can build a traditional dart or glider from copy paper and a giant version using a posterboard to test if the smaller or larger version performs better.*
- Students analyze their flight data. For each airplane design students:
 - Calculate mean, five-number summary, standard deviation.
 - Construct confidence intervals.
 - Compare plane means to determine if their hypothesis was accurate.
- Students will use graph paper or digital tools such as Desmos or Excel for calculations and plotting of their data.

Closing/Reflection

- Discuss findings in pairs, small groups, or as a class.
- Students complete the ticket out the door:
 - Which plane flew the farthest on average? Was their hypothesis correct?
 - Was the difference statistically significant? Why or why not?
 - What would they do differently in a future test?
 - How did the artworks that they looked at at the beginning of class influence their final design?

ASSESSMENTS

Formative

- Student created data table
- Student created airplanes
- Student responses to opening questions

Summative

- Confidence interval calculations and plotting of data
- Student reflections and ticket out the door

DIFFERENTIATION

Acceleration:

- Linear regression: Test how weight (paperclips, staples) affects distance.
- Material comparison: Use different types of paper for performance testing.
- Art integration: Build a full “gallery” of artistic conceptual planes and write artist statements explaining their choices.

Remediation:

- [Review box and whisker plot](#)
- [Review confidence intervals](#)
- Allow students to work with a partner

ADDITIONAL RESOURCES



**This integrated lesson provides differentiated ideas and activities for educators that are aligned to a sampling of standards. Standards referenced at the time of publishing may differ based on each state's adoption of new standards.*

Ideas contributed by: Kevin Kennedy, Shannon Green, Gretchen Hollingsworth

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