

Morphometrics of Skulls

Title: The Morphometrics of Skulls

Author(s): Marian Geist

Grades: 6-8

Subjects: Math and Science



Overview of Lesson Plan:

Students learn about the morphometrics of skulls by measuring skulls, recording data and prepare graphs to analyze selected measurements. This could be an activity completed in the math classroom prior to the study of evolution in the science classroom, because students are able to study the skulls in a very objective manner. Because of the experience in measuring, students are beginning to draw conclusions that there are similarities between the skulls.

Suggested Time Allowance: 4-5 class days

Objectives:

Students will learn about key identifiers of the skulls.

Students will be able to identify the types of teeth as related to diet.

Students will be able to display and analyze data through the use of graphs.

Resources / Materials: Collection of Skulls (OHSU Teaching Lending Library)

Activities / Procedures Day 1 and 2

Introduction: Use Skull Powerpoint as an introduction. Modified from:

www.eeb.bio.utk.edu/biologyinbox/powerpoints/Unit2-OfSkulls&Teeth.ppt

Students work in groups of 4 to collect data about skulls

Data is recorded in a table. (Table included in Appendix A)

Homework: Two selected characteristics from all skulls are graphed in a scatterplot.

Students determine whether there is a correlation between the measurements of the skulls.

Activities / Procedures Day 3 and 4

Introduction: Students are introduced to the types of teeth and diets with a powerpoint presentation modified from: www.eeb.bio.utk.edu/biologyinbox/powerpoints/Unit2-OfSkulls&Teeth.ppt

Discuss the differences between carnivores, herbivores, insectivores, and omnivores.

Students predict the type of diet by studying the skull's teeth.

Data about teeth is collected and recorded in a table. (Table included in Appendix B)

Homework: Students complete dental formula for each skull.

Bar Graphs comparing the numbers of incisors, canines, pre-molars and molars are completed.

Further Questions for Discussion:

What similarities would be found among other skulls such as a horse, deer, elk, and moose?

What similarities would be found the skulls of a wolf, fox, and dog?

Would there be similarities between the skull of a lion, tiger, bobcat, and a domestic cat?

Evaluation / Assessment: Students will be able to measure accurately, collect data and produce bar graphs and scatterplots.

Vocabulary: Morphometrics, Sagittal Crest, Foramen Magnum, Supraorbital, Carnivore, Herbivore, Insectivore, Omnivore, Dental Formula, Incisors, Canines, Premolars, Molars, Scatterplot, Slope, Correlation

Extension Activities:

Measure the volume of the brain cavity using rice or dried beans.

Use clay to fill in the sides of the skull to determine the amount of muscle mass needed to connect the sagittal crest to the jaw.

Groups of students could be given one skull to study thoroughly and present their findings to the class. They could make predictions about the type of diet and the habitat where the animal lived. The names of the skulls could be given and then through research, the group would have to determine which skull they had been given.

Morphometrics of Skulls - Mathematics Content Standards

- 6.3 Algebra: Write, interpret, and use mathematical expressions and equations.
 - 6.3.5 Represent, analyze, and determine relationships and patterns using tables, graphs, words and when possible, symbols
- 7.2 Number and Operations, Algebra and Geometry: Develop an understanding of and apply proportionality, including similarity.
 - 7.2.1 Represent proportional relationships with coordinate graphs and tables, and identify unit rate as the slope of the related line.
- 8.2.1 Organize and display data (e.g., histograms, box-and-whisker plots, scatter plots) to pose and answer questions; and justify the reasonableness of the choice of display.
 - 8.2.2 Use measures of center and spread to summarize and compare data sets.
 - 8.2.3 Interpret and analyze displays of data and descriptive statistics.
 - 8.2.4 Compare descriptive statistics and evaluate how changes in data affect those statistics.
 - 8.2.5 Describe the strengths and limitations of a particular statistical measure, and justify or critique its use in a given situation.

Morphometrics of Skulls - Science Content Standards

- 6.3S2: Scientific Inquiry: Organize and display relevant data, construct an evidence-based explanation of the results of an investigation, and communicate the conclusions.
- 7.3S2: Scientific Inquiry: Scientific inquiry is the investigation of the natural world based on observation and science principles that includes proposing questions or hypotheses, designing procedures for questioning, collecting, analyzing, and interpreting multiple forms of accurate and relevant data to produce justifiable evidence-based explanations. Organize, display, and analyze relevant data, construct an evidence-based explanation of the results of an investigation, and communicate the conclusions including possible sources of error.
- 8.3S1: Scientific Inquiry: Based on observations and science principles propose questions or hypotheses that can be examined through scientific investigation. Design and conduct a scientific investigation that uses appropriate tools, techniques, independent and dependent variables, and controls to collect relevant data.
- 8.3S2: Scientific Inquiry: Organize, display, and analyze relevant data, construct an evidence-based explanation of the results of a scientific investigation, and communicate the conclusions including possible sources of error. Suggest new investigations based on analysis of results.

Morphometrics - The Quantitative Analysis of the Shape of Organisms

Record your measurements in the table. All measurements should be measured in centimeters (cm).

1. Measure the maximum WIDTH of the brain case (cranium).
2. Measure the maximum LENGTH of the brain case (from the bridge of the nose to the base of the cranium).
3. Measure the constriction behind the eye orbits (sockets).
4. Does the skull have a bony ridge on top or sides?
5. Hold a ruler upright from the bridge of the nose. Does the frontal bone slope back flatly or does it rise vertically?
6. Is the hole where the spine attaches directly underneath or angled to the back? Use your fingers or a ruler to determine this.
7. Is the bone behind the ear well-developed (easy to see) or is it flat?
8. Does the skull have a bony ridge over the eyes (supraorbital)?
9. Distinguish between skulls if a brow ridge is present. Example: smallest, small, medium, large.
10. Is the nasal bone arched (peaked) or flat?
11. Does the face (below eye orbits) stick out in front of the forehead? Compare amounts between skulls.
12. Use tape measure and ruler to measure from the bottom of the mandible to the top of the nasal opening.
13. Does the chin stick out or does it slope back?

<http://www.accessexcellence.org/AE/AEPC/WWC/1995/hominoidscomp.php>