

Evolution: Evidence and Explanations for the Unity and Diversity of Life

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Science Education for Public Understanding Program

- Science curriculum design and professional development
- Based at the Lawrence Hall of Science, University of California at Berkeley
- Designing science curriculum, working with teachers, and supporting quality science instruction since 1983
- Major funding for curriculum work from the National Science Foundation





Lab-Aids, Inc.

- Publishes and supports the use of SEPUP materials in classrooms across the United States
- Publishing quality science curricular materials, providing curricular support since 1963
- Based in Ronkonkoma, New York

Science and Global Issues (SGI)

- NSF curriculum development project
- Uses sustainability as the unifying context for studying important biological concepts
- Inquiry-based, issue-oriented science...
 - Students talk, think, and discuss content as it relates to personal, societal, and global issues
 - Students learn to use evidence in the decision-making process
- Embedded assessments and literacy strategies
- Research-based and extensively field tested

Sustainability

- In the context of human development:
 - Meeting the needs of the present without compromising the ability of future generations to meet their own needs
- Examined through three perspectives:
 - Environmental, economic, and social
- Considered on three levels:
 - Personal, community, and global

Science and Global Issues: Biology

Unit	Content focus	Sustainability focus
Sustainability	Interdisciplinary	Sustainability from a personal, community and global perspective
Living on Earth	Ecology	Human influence on ecosystems
World Health	Cell Biology	Global health issues
Feeding the World	Genetics	Use of genetically modified organisms
Maintaining Diversity	Evolution	Changes in and threats to biodiversity

Innovative Activities

- Show how content and problems or issues can be integrated
- Address TEKS High School Biology :
 - 7A: Analyze evidence of common ancestry provided in the fossil record
 - 7B: Analyze and evaluate explanations concerning. . .sequential nature of groups in the fossil record
 - 7C: Analyze how natural selection produces changes in populations, not individuals

Activity: Whale Evolution

- Fifth activity in unit
- Students have studied biodiversity, geologic time, Darwin's theory
- In the next two activities they will continue to study the fossil record and natural selection
- Students comfortable with 4-2-1 model and literacy strategies

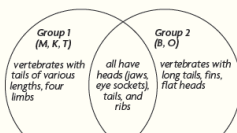
Activity: Whale Evolution

Conduct Procedure Steps 1-6

Sample Student Response: Similarities and Differences between Groups

	Similarities	Differences
Group 1 skeletons (M, K, T)	<ul style="list-style-type: none"> vertebrates All have tails, four limbs, jaws, and eye sockets. 	<ul style="list-style-type: none"> jaws/snouts (shape of head) length of tail T has front limbs that are shorter, and both back and front limbs look flipper-like. shape of pelvis nearness of the ground straightness of
Group 2 skeletons (B, O)	<ul style="list-style-type: none"> vertebrates All have long tails, fins, similar jaws, and flat heads. 	<ul style="list-style-type: none"> relative size of presence/absence number of ribs presence/absence curvature of s

Sample Venn Diagram to Compare Groups 1 and 2

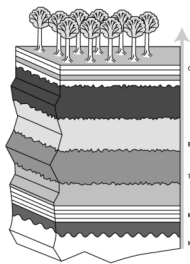


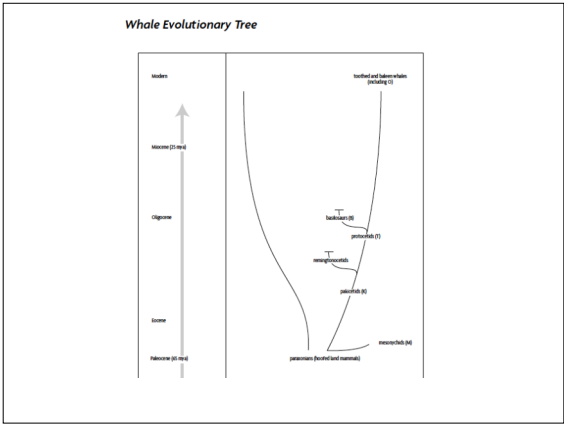
Whale Evolution

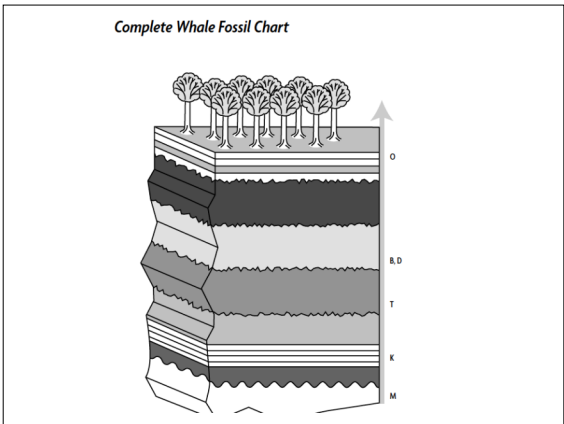
- Conduct Steps 7-10, letting me know when you need:
 - Student Sheets (5.1 and 5.2)
 - Cards A and D
- After Step 10, review the analysis questions.

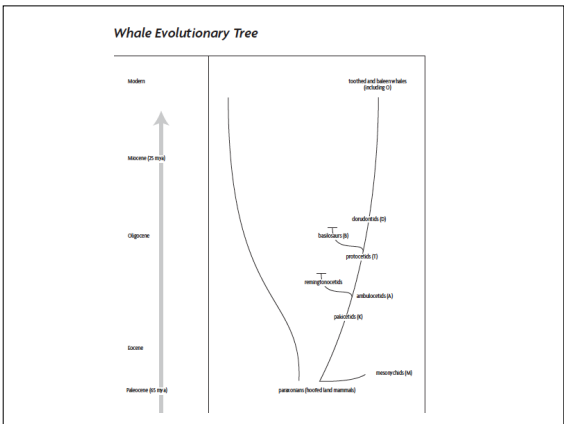
Whale Fossil Chart

The layers of rock shown are called strata. Deeper strata are older, while upper strata are more recent.





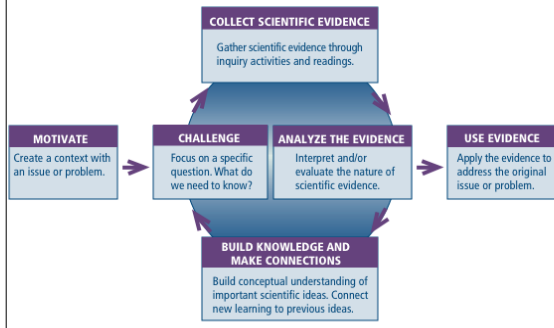




Evolution Topics

- Biodiversity
- Geologic time
- Fossil record
- Darwin
- Theory of evolution by natural selection
- Evolutionary trees
- Biological species and speciation
- Evidence for evolution
- Adaptation
- Microevolution
- Macroevolution
- Extinction
- Adaptive radiation

SEPUP: Instructional Model for Issue-oriented Science



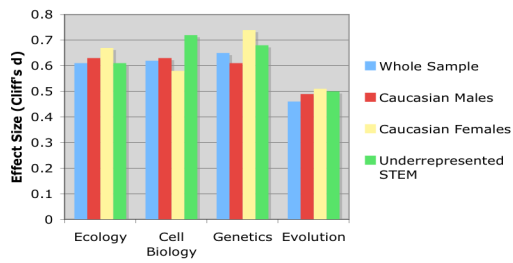
Why Issue-oriented Science?

- Integrates sciences & science with other subjects
- Realistic view of how science contributes to solving problems and the role of science in careers
- Real-world connections
- Use of science in daily life
- More authentic science, for ALL students
- Helps students learn science
- Improves student attitudes toward science

Development Process

- Iterative process of development, testing, expert review, evaluation, and revision developed and refined over 22 years of NSF funding
- Develop learning outcomes, assessments, and rough activities; pilot locally
- Refine activities and field-test nationwide; teachers receive PD; 1-2 cycles per unit
- Evaluate
 - Internal evaluation of usability for T and S
 - External evaluation of learning outcomes and pedagogy
 - External evaluation of scientific content

SGI: Biology Pre-Post Effect Sizes



Small effect size Cliffs d = 0.147; medium effect size Cliffs d = 0.330; large effect size Cliffs d = 0.474 (Cliff, 1993; Romano et al, 2006).

Science and Global Issues: Biology

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SEPUP - www.sepuplhs.org

Lab-Aids in exhibit hall

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