

Introduction to CAMEOS

• **CAMEOS** (Coastal, Atmospheric, & Marine Environmental Observing Studies) is an NSF GK-12 program based at the UC Davis Bodega Marine Laboratory (BML)

• CAMEOS Fellows include marine and terrestrial ecologists, oceanographers, evolutionary biologists, and ecotoxicologists

CAMEOS Participants	
National Science Foundation	8 Graduate Fellows
	10 Teachers
	600 Students
UC Davis and CSU Sonoma Faculty	Oikonos and Ocean Discovery!
	Bodega Marine Laboratory

Marine Debris: A Global Problem

- Plastic debris persists in the marine environment indefinitely
- We used this issue as the foundation for developing an inquiry-based science curriculum
- Curriculum focused on understanding:
 1. Transport of debris from land to sea through local watersheds
 2. Effects on albatross and other organisms

Great Pacific Garbage Patch

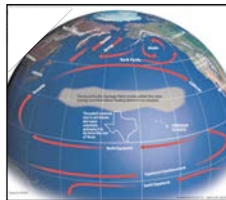


Image Courtesy of NOAA

Marine Debris Project GOALS

- Bring inquiry-based learning to science classrooms
- Guide students through self-directed research projects
- Promote ocean literacy and stewardship
- Train fellows to communicate science to a broad audience



Photo Courtesy of Michelle Hester and Cynthia Vanderlip

Developing Scientific Inquiry Skills

The Marine Debris Project activities use various levels of **scientific inquiry** as students employ different **types of knowledge** (after Anderson et al. 2001).

Levels of Scientific Inquiry

Structured	Guided	Open
Students are given the question and methods but discover the answer	Students are given the question but create the methodology, collect data, and formulate explanation	Students formulate the question, methods and solution using personal observations and previous knowledge

Levels of Knowledge

Factual	Conceptual	Procedural	Metacognitive
Knowledge of terminology	Knowledge of classifications, categories, principles, and generalizations	Knowledge of techniques and methods	Strategic knowledge and self-knowledge

Anderson, L.W., D.R. Krathwohl, P.W. Airasian, K.A. Cruikshank, R.E. Mayer, P.R. Pintrich, J. Raths, M.C. Wittrock, editors. *A Taxonomy for Learning Teaching and Assessing*. New York: Longman Inc.; 2001.

STAGES of Inquiry-Based Learning

Background Information & Introduction to Scientific Inquiry

Structured Inquiry using Factual and Conceptual Knowledge

- Introduced to marine debris and seabirds
- Mapped currents and albatross migration
- Learned what constitutes a good scientific question

Formulating Hypotheses & Designing Experiments

Guided Inquiry using Procedural Knowledge

- Brainstormed questions related to marine debris
- Developed testable hypotheses
- Example: "Plastic types and colors found on campus are similar to plastics found in albatross boluses"
- Designed methods to test hypotheses

Collecting Data

Structured Inquiry using Conceptual Knowledge

Sonoma County Debris Surveys

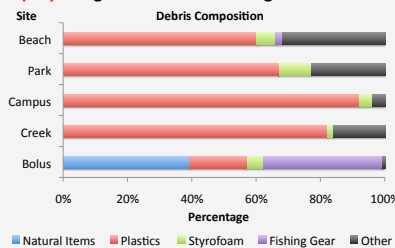


Photo Courtesy of Cynthia Vanderlip

Analyzing Data & Drawing Conclusions

Guided Inquiry using Procedural Knowledge

- Organized and presented data
- Compared data from debris surveys and bolus dissections
- Identified potential origins of marine debris



Asking more Scientific Questions and Proposing Solutions

Open Inquiry using Procedural and Metacognitive Knowledge

- Formulated additional hypotheses and methods about marine debris
- Proposed individual and policy solutions to this environmental issue

Outcomes of Marine Debris Project

Graduate Fellows:

- Experienced teaching to a diverse student body
- Developed skills for writing science curricula and guiding student research
- Collaborated across disciplines

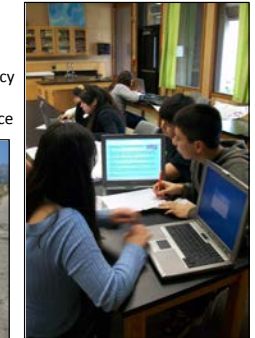


High school students:

- Thought critically, creatively & scientifically
- Participated in inquiry-based learning
- Practiced working in cooperative groups
- Developed computer skills
- Connected with fellows as mentors

Broader Conservation Implications:

- Bridged connections between human activities and ocean health
- Formed a scientific basis for ocean advocacy
- Exposed culturally and socioeconomically underrepresented groups to marine science



Future Directions

- Further integrate technology into classroom activities and student research
- Use scientific inquiry skills developed during the Marine Debris project to facilitate future self-directed student research projects

Actual Student Research Topics

Does cattle grazing increase native herb diversity in California coastal prairie?
Tamales High School

How is noise pollution affecting daphnia's ability to evade predators?
El Molino High School

What California native plants do invasive snail species prefer to eat?
Santa Rosa High School

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