**A. The Experience for Graduate Students**

This course is designed to provide a team of graduate student Teaching Assistants (TAs) a complete teaching experience, under the guidance of a faculty mentor. They choose the course theme and course materials, determine the class activities and assessments, and teach the course. Each TA has the class for three meetings and is expected to incorporate a variety of teaching methods (lecture, group discussion, hands-on activities, etc.). Several aspects ensure that the TAs receive a high level of support and feedback.

#### Discussion Course in Teaching Methods

The semester before the course begins, the TAs participate in a discussion group that reads and discuss articles on teaching methods (faculty from the Oceanography department also participate). Topics such as ‘designing a syllabus’ and ‘leading a class discussion’ are covered.

#### Peer Evaluation

Each TA attends every class meeting, whether or not they are teaching that class. After each class, the TAs meet in a 'debrief' and discuss what worked, what didn’t, and how they could improve.

#### Faculty Evaluation

The faculty mentor attends classes as he or she is able to and participates in the ‘debrieﬁng’ afterwards. For one class per TA the faculty mentor attends the class and completes a ‘Peer Evaluation’, using the same form with which TAs are evaluated. They later discuss this evaluation with the TA.

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**B. The Experience for Undergraduates**

The course uses active-learning approaches to teach critical-thinking and scientific-inquiry skills to undergraduates. Specifically, students learn to:

- **Read critically**: identify hypotheses, consider alternatives, and find hidden assumptions.
- **Synthesize complex, conflicting and incomplete data into a larger perspective**: explicitly consider how multiple threads of research are combined into larger themes and how different readings agree or conflict.
- **Identify logical future research directions**: develop hypotheses and ways to test them.
- **Consider the role of science in decision-making**: the integration of imperfect scientific information into societal decisions.

**C. Course Design**

The course meets once per week for 2 hours. Each TA is responsible for teaching a 3-week section; each section has a different topic but coordinates with the larger theme. Each year the theme and topics change as new TAs design the course. The syllabus from 1968, the first offering of the course, is given here as an example. The theme for this year was Extreme Environments.

**D. Table 1: Summary of Class Activities and Content**

<table>
<thead>
<tr>
<th>Class Assignment</th>
<th>Class Activity</th>
<th>Topic Goal</th>
<th>Broader Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Individual reading assignment, brief oral presentation</td>
<td>20 min mini-lecture at start, presentations and discussion</td>
<td>Links between ocean circulation and climate</td>
<td>Synthesis of complex info into larger picture</td>
</tr>
<tr>
<td>2. Evaluate “global warming will start the next ice age by shutting down deep ocean circulation.” True? What information do we have supporting it? Conflicting with it? What critical information are we missing?</td>
<td>Course discussion to produce list of what information we lack for answering the homework</td>
<td>Paleoecology via ice cores &amp; isotopes</td>
<td>Scientific progression of warming from what is known to what needs to be discovered</td>
</tr>
<tr>
<td>3. Read and evaluate a mock scientific proposal Mock proposal review panel</td>
<td></td>
<td>Proposal and grant funding process</td>
<td>Experimental design, finding primary literature in library</td>
</tr>
</tbody>
</table>

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**“Scientific Inquiry in Oceanography: Extreme Environments”**

**In Development for Environmental Systems**, UCSD

**“Case Studies in Environmental Data Analysis”**

**In Development for Environmental Systems**, UCSD

**Overview**

A new upper-level undergraduate course is in the early stages of development as part of a proposal submitted to the NSF National SMETE Digital Library Program on 4/17/02 (P. S. Miller, Co-Pi K. Stocks, P. Hastings, J. Heil, C. Peach, and B. Schottlaender). The overall project would create the SIO Collecton Gateway, a web-based access and inquiry tool for the collections of the SIO Institution of Oceanography (SIO).

**The Collections Data**

The four collections at Scripps (Marine Vertebrates, Benthic Invertebrates, Pelagic Invertebrates, and Geologic Collections) collectively contain over 2 million specimens, each recording the latitude, longitude, depth and date when a particular species or sediment type was collected. Combined, these data can be used to explore the distribution of species over the oceans, the relationships between a species and its geological/physical environment, and how these patterns change over time.

**The Gateway**

The Gateway will be an online center with tools for finding, mapping, and analyzing data in the SIO Collections. It will be an expansion of the NSF-supported SIOCollecton system and will have separate research-level and educational interfaces. For the educational interface, intuitive, graphic tools will allow students to ask “what do we know about this place”, retrieving all information about samples there; or “What do we know about this species” retrieving and mapping data where that species has been found, linking to supplementary text and images about the ecology of that species, and connecting to a tool that analyzes how the distribution of that species might change with global climate change.

**The Course**

This course is being developed as a junior-year, major’s course through the Environmental Systems program at UC San Diego. Its primary purpose will be to prepare students to complete an independent research experience in their Senior year, moving them through the critical transition from learning science to doing science. Small groups of students will work together in this lab-style class to address a particular question in ocean science, e.g.:

- Where would you site a reserve to best protect the commercially and recreationally important rockfish?
- How would a hypothetical proposed sewage outfall affect the surrounding marine habitats?
- If the rate of nitrogen input into the coastal waters increased by 50%, predict the resulting change in the distribution of hypoxic waters and its effects on the distribution of bottom-living communities?

The students will identify the information they need to address their question (from the Gateway and elsewhere), collect that information, analyze and synthesize it, and finally present their findings in the form of a web page.