Framework for an Open Inquiry Curriculum: Engaging Students Through Independent Research Projects in Local Environments

J.R. Bean, R. Eberl, R.E. Fontana, D. Trockel, A. Newsom, S.A. Gravem, B.S. Cheng, M. Byrd, M. Chow, V. Chow, S.L. Williams

1. University of California at Davis, Bodega Marine Lab. 2. Ocean Discovery!

Introduction to CAMEOS
• CAMEOS (Coastal, Atmospheric, & Marine Environmental Observing Studies) is an NSF GK-12 program based at the UC Davis Bodega Marine Laboratory
• CAMEOS fellows include: marine and terrestrial ecologists, oceanographers, evolutionary biologists, applied mathematicians, and computer scientists

Open Inquiry Curriculum for Independent Research Projects
• CAMEOS curriculum teaches science content and creative and critical thinking skills through scientific research.
• In open inquiry investigations, students formulate questions and methods from personal observations and acquired knowledge.
• Fellows provide instructional scaffolding in learning activities for students to develop skills necessary for conducting scientific research.

<table>
<thead>
<tr>
<th>Learning Skill</th>
<th>Open Inquiry Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>observational</td>
<td>watching grey escape predators</td>
</tr>
<tr>
<td>auditory</td>
<td>listening to group members’ ideas</td>
</tr>
<tr>
<td>spatial</td>
<td>deciding where or when to collect data</td>
</tr>
<tr>
<td>visual</td>
<td>displaying data using scatter plots and bar graphs</td>
</tr>
<tr>
<td>mathematical</td>
<td>comparing means from experimental data</td>
</tr>
<tr>
<td>statistical</td>
<td>interpreting real-life meaning of results</td>
</tr>
<tr>
<td>linguistic</td>
<td>explaining experiment to an audience</td>
</tr>
<tr>
<td>interpersonal</td>
<td>reflecting on potential experimental improvements</td>
</tr>
<tr>
<td>intrapersonal</td>
<td>organizing and overcoming obstacles as a group</td>
</tr>
</tbody>
</table>

Independent Research Environments

CAMEOS Participants
- National Science Foundation
- 8 Graduate fellows
- 30 teachers
- 400 students
- UC Davis and CSU Sonoma Faculty
- Oikonos and Ocean Discovery!
- Bodega Marine Laboratory

Scaffolding Sequence in Open Inquiry

<table>
<thead>
<tr>
<th>Student Directed</th>
<th>CAMEOS Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher, fellow and student mediated</td>
<td>National Science Foundation</td>
</tr>
<tr>
<td>Teacher, fellow directed</td>
<td>8 Graduate fellows</td>
</tr>
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</tbody>
</table>

Learning Skills
- Linguistic
- Visual
- Interpersonal
- Mathematical
- Spatial

Student Presentations and Assessment
• The all day CAMEOS Symposium at the Bodega Marine Lab is the culminating event of the open inquiry project.
• Student practice communication skills and their understanding of scientific concepts through research presentations.

Data Analysis
Students implement their methods with support of fellows and teachers

Data Collection
Students graph data and interpret their findings

Research Symposium
Students present their research to scientists, teachers, and peers

Methods Design
Students design observational and experimental studies

Data Analysis
Students implement their methods with support of fellows and teachers

Learning Skills
- Observational
- Analytical
- Linguistic
- Interpersonal
- Spatial
- Interpersonal
- Intrapersonal

Student Presentations and Assessment
- Students arriving at Bodega Marine Laboratory for the CAMEOS symposium.
- Example title slides from student presentations.

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