The SMILE Program

High School Ocean Sciences Challenge 2007

Contents

What is the SMILE High School Challenge? 2

Day 1: Sea Safety and Cruise Planning at Western Oregon University 3
Welcome and Introductions 3
Gumby Suit Activity 3
Setting up the Challenge 4
Sea Safety Planning 4
Oceanographic Exploration 4
  Glider Research at OSU 5
  Harmful Algal Blooms 5
Marine Careers 6
Nautical Charts 6
Sea Safety Gear 6
Planning the Cruise 7

Day 2: Specialist Sessions and Field Activities at OSU 8
Welcome 8
Specialist Sessions 8
  GPS Technology 8
  Search and Rescue Procedure 8
  Navigation 9
  Predictions Based on Models 9
  Remote Sensing and Mapping 9
College Connection Sessions 10
GPS Scavenger Hunt! 10
Identifying a Search Area 10
Campus Quad Rescue! 11
Team Debrief 13
Closing Address 13

Appendix: Background on The SMILE Program 14
About SMILE 14
HS Program Model 15
HS Program Evaluation 16
The SMILE Program based at Oregon State University (OSU) is a collaborative effort to target underrepresented students around the state of Oregon. SMILE began in 1988, serving 80 students in four middle schools. Today, the program serves more than 700 elementary, middle, and high school students, along with 60 teachers, in 35 schools. The areas served are poor, largely rural, and educationally under-served with significant numbers of Native American and Hispanic students. The primary objectives of the program are to improve high school graduation rates and increase the number of students attending college and ultimately choosing careers in science, technology, engineering or math related fields (STEM careers).

The High School Challenge supports the use of science in the context of a community problem. Oceanography topics are chosen that use the expertise of faculty and graduate students to provide learning opportunities for both students and teachers in SMILE’s after-school clubs. At the Challenge SMILE students use ocean sciences, satellite data, and related technology to solve problems and answer community concerns. This is designed to provide motivation for awareness of the role of the ocean and remote sensing in many aspects of our lives, as well as in a variety of careers.

Through this experience, underrepresented students who have demonstrated an interest in science and mathematics, high school teachers of mathematics and science, and underrepresented community members around the state of Oregon become more aware of oceans and the ocean sciences. In 2007 high school student teams planned an oceanographic cruise, learning about different types of oceanographic research and the uncertainties involved in field science. Those uncertainties became evident when on the second day of the challenge the students had to put off their research plan to help rescue a lost vessel. They employed a number of strategies to find the lost ship, including a campus-wide scavenger hunt for information using GPS. Approximately 125 students from 12 schools attended the 2007 challenge event. This narrative describes this year’s events as an example of what can be accomplished at the Challenge.
Day 1: Sea Safety and Cruise Planning at Western Oregon University

Students arrive at Western Oregon University (WOU) to begin the challenge on the afternoon of Thursday, April 12th. Many students and their club advisors have been traveling for hours to reach the event, some from as far as the Idaho border. On arrival, students are broken up into their challenge teams. Each team has an OSU student mentor who will help facilitate the Challenge activities, and one or two students from different schools, to a total of approximately ten students per team.

Welcome and Introductions

On arrival in their teams the students receive a welcome address and hear about college life from a panel of WOU students and admissions representative. Then the students are given some time to get to know each other. Mentors lead the teams in ice-breaker activities and introductions. For the students, who are from all over the state and who may have never met their other team members, this is an important piece of the social element of the Challenge.

Gumby Suit Activity

This year a special team building activity was planned. Ocean survival suits, or “Gumby suits” as they are often called, are important safety equipment at sea. Within their teams the students are presented with a scenario: someone must don the survival suit in order to patch a hole in the hull of their ship. The “patch” is a tangram puzzle the students must solve. The student in the suit cannot speak and must act on direction from the other team members, but they are also the only person who can manipulate the puzzle. It was a challenge, but with some help from their mentors each team found their solution!
Setting up the Challenge

After the get-to-know-you activities and dinner, the students regrouped in their teams for the Challenge introduction. The students were presented with the task of planning an oceanographic cruise to study a phytoplankton bloom off the coast of Oregon. Data for the scenario was developed by Dave Foley of NOAA’s Coast Watch program, based on actual historical satellite data for the area. Before they began to develop their plans, the students had some sessions to help them prepare for their roles as oceanographers in the field.

Sea Safety Planning

Kaety Hildenbrand is a Sea Grant Extension officer for Lincoln County, Oregon. She routinely leads sea safety courses to help prepare researchers and students for emergencies at sea. Hildenbrand was invited to brief the students on these topics, to help set the scene for the cruise planning activity.

Oceanographic Exploration

Following Hildenbrand’s safety briefing, the student teams broke into groups to further prepare for their cruise planning by exploring some other topics in more depth.
Glider Research at OSU
Tristan Peery, a graduate student in physical oceanography at OSU’s College of Oceanic and Atmospheric Sciences (COAS) described cutting edge research using autonomous underwater vehicles. Peery brought one of the $100,000 gliders that students could examine first-hand, and a PowerPoint describing his research and the kind of data the gliders collect.

Harmful Algal Blooms
Coral Gehrke, a master’s student in Marine Resource Management (MRM) at OSU, presented a session on harmful algal blooms (HABs). She described what makes a bloom ‘harmful,’ the types of HABs observed in Oregon, and the methods scientists use to study them. This session gave the students some tools to use to study the bloom they would be investigating on their cruise.
Melissa Feldberg from Sea Grant and Luke Spence, an officer in the NOAA Corps, presented a session on marine careers. This session encouraged the students to think about the different ways that they could find employment in ocean-related activities, from researchers to technologists and crew.

**Marine Careers**

Dan Smith, also a master’s student in the MRM program at OSU, led a session exploring nautical charts of the Oregon coast. He helped the students read the charts and locate the area they will be exploring on their cruises.

**Nautical Charts**

Finally, students had a hands-on opportunity to explore Kaety Hildenbrand’s safety gear, including learning about EPIRB devices, tasting life raft emergency rations, and trying on personal flotation devices.

**Sea Safety Gear**

Students get hands-on with safety gear.
Planning the Cruise

After the hands-on sessions the students regrouped with their teams and debriefed what they learned. Then the final activity for the day was explained. Each student team was responsible for completing a cruise plan, outlining what route they planned to take and what type of data they hoped to collect. Cruise tracks were restricted to approximately 250 nautical miles on Oregon’s Heceta Bank. Completed student cruise plans had to be approved by program “grant officers:” Karen Wegner from The Center for Coastal Margin Observation and Prediction (CMOP) and Amy Vandehey from CIOSS. After each team received approval, the evening adjourned for recreation and a break until the activities resumed early the next morning.

Students use the information they collected during the Oceanographic Explorations sessions to plan how they will study a phytoplankton bloom off the Oregon Coast.

Amy Vandehey of CIOSS and Karen Wegner of CMOP review and approve student research plans.
Day 2: Specialist Sessions and Field Activities at OSU

Welcome
After spending the night in WOU dorms the students and teachers travel to OSU, where the second day of the Challenge opens. After a brief welcome in the Memorial Union ballroom, team members signed up for 2 hour specialist sessions. Each team sent representatives to each session in order to gather information that would assist them in the day’s activities, which were still unknown to the students.

Specialist Sessions
This year’s specialist sessions included:

GPS Technology
MRM students Anna Pakenham and Eleanor Hodak presented a practical introduction to compass and GPS navigation.

Search and Rescue Procedure
Wally Cutchin of the Yaquina Bay Coast Guard Station briefed students about the Coast Guard and techniques for open ocean search and rescue.

Wally Cutchin of the Yaquina Bay Coast Guard Station briefs the students on Search and Rescue procedures.

MRM students Eleanor Hodak and Anna Pakenham lead students in activities using GPS units and compasses.
Navigation

Molly Phipps from the Department of Science and Math Education at OSU and NOAA Corps officer Luke Spence guided students through the use and construction of a model sextant while exploring ocean navigation, past and present.

Predictions Based on Models

Dave Foley from NOAA’s Coast Watch program demonstrated how scientists use computer models of ocean physics for practical applications.

Remote Sensing and Mapping

Michelle Kinzel from the Department of Geosciences at OSU helped students explore satellite imagery and discover how data is used to produce colorful maps and images.
**College Connection Sessions**

After the specialist sessions, students break into class year groups to attend college connection sessions. These sessions are specially targeted to give each group information they may need about college and decisions leading to college. After these sessions students adjourned for lunch at an OSU dining hall.

**GPS Scavenger Hunt!**

After lunch students return to the ballroom and debrief the morning specialist sessions in their teams. As students begin to re-examine their cruise plans from Thursday evening, an important announcement is made: a research vessel exploring the area the students have been investigating has been lost! Students, in their roles as researchers experienced with the area, are enlisted by the Coast Guard to help them narrow down their search. To do this, the students must collect information they can use to calculate where the ship is most likely to be found. They do this as part of a scavenger hunt around campus using GPS devices. Student teams and mentors set off to find 4 locations around campus where they will receive information they can use to find the ship.

**Identifying a Search Area**

Each team returns from the scavenger hunt with the same set of clues: a map of the cruise track of the missing ship, record of a distress call, a satellite image of sea surface temperature in the area, and a drift model developed by Coast Watch. Putting these clues together the students are instructed to narrow their search area down to a 20 x 30 km quadrant. Luke Spence and Karen Wegner stand in as Coast Guard representatives helping check student work.

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**Clues about the ship’s planned cruise track, a distress call, shipboard sea surface temperature data, and a drift model of local currents help the students locate the ship.**

**GPS units guide students to scavenger hunt sites where they gather data clues to help them find the missing ship.**
After the teams decide where they plan to search, they transition in their roles from rescue planners to the on-the-ground teams conducting the search. The Memorial Union quad has been set up with scaled search areas for each team. Each team member is assigned a role. *Ground control* is based in the center of the quad where students form each team keep track of where their team has searched and organize search patterns. *Helicopters* are composed of a scanner who searches the “sea surface” with a limited field of view, and a navigator who helps guide them. Helicopters move slowly and can advance only by placing one foot directly in front of the other. *Planes* may move quickly, but can only circle the perimeter of the search area. *Communications Reps* help relay information between helicopters, planes and ground control. The “ship” the students are searching for is an inch-long dowel somewhere in the search area.

*Campus Quad Rescue!* Students share how they used the data to predict the ship’s location.
Once the students locate the ship there is one more twist. It turns out that a life raft has been released. Students receive one more clue that allows them to calculate the drift of a raft relative to the location of their ship and locate the ball bearing that represents it in their search area. All 12 ships and life rafts were successfully rescued!

The role of *Ground Control* is to oversee the search and keep track of where the ship is found.

Students locate the life raft based on where they found the ship and local currents and winds.
Team Debrief
As teams return to the ballroom after their successful rescues, they are encouraged to debrief their experience. Students discussed:

• What worked, and what didn’t, comparing rescue plans/experiences
• What would be a problem in using the science to define probabilities?
• The role of preparation
• Realities of marine research: dealing with the unexpected, Revision of cruise research plan given lost days/resources.
• Comparison of Thursday night cruise plan with Friday “real” plan.

Students and team mentors also completed their program evaluations.

Closing Address
SMILE Director Eda Davis-Butts presented awards to SMILE students. Bill Hanshumaker from Hatfield Marine Science Center gave the closing address. He spoke about his field research in the Antarctic.

The challenge is dismissed for another year!
Appendix: Background on The SMILE Program

About SMILE

The SMILE (Science and Math Investigative Learning Experiences) Program is a collaborative effort to target underrepresented student populations around the state of Oregon. The objective is to improve high school graduation rates, as well as increase the number of students attending college and ultimately choosing careers in science or math related fields.

SMILE connects scientists and mathematicians with Oregon school districts in order to provide after-school clubs for science and math enrichment and professional development workshops for club teachers. The high school club activities culminate in the annual SMILE High School Challenge, a day and a half long event in April on the campuses of Western Oregon University and OSU. Student teams are presented with an open-ended community-based problem related to oceanography and work together to gather data and create and present a plan to address the problem. Past challenge scenarios have focused on coastal oil spills and fisheries management issues. A masters student in the Marine Resource Management program at the OSU College of Oceanic and Atmospheric Sciences coordinates the development of the high school club activities, challenge scenario, and teachers’ workshops during the year, working with Ryan Collay and other members of the SMILE staff. University researchers and students lend expertise to the challenge content and serve as mentors and role models for SMILE participants.

To produce events like the annual Challenge, SMILE relies on partnerships with research programs and other institutions. Recent partners in the production of high school ocean science content include the Cooperative Institute for Oceanographic Satellite Studies, the Center for Coastal Margin Observation and Prediction, and Oregon Sea Grant.

Demographics of SMILE club members.
The High School Program Model

Clubs and High School Challenge
- Engage researchers and graduate students in the development and delivery of club activities and problem-based scenarios in the context of ocean sciences
- Increase teacher understanding of ocean sciences and the use of satellite data in engaging students
- Provide learning opportunities in ocean sciences for high school students in club settings and through the on-campus challenge event
- Involve undergraduate and graduate students as mentors to facilitate team engagement and progress and to serve as college-student role models
- Promote preparation and greater aspirations for higher education among SMILE high school students
- Increase awareness of science-based careers among SMILE high school students

High School Challenge Model
- Involve students in teams where they engage in a process to solve a problem
- Teams have college student mentors that are team guides and role models for college
- Team members bring expertise they’ve learned in their clubs from a variety of interrelated sciences
- Teams develop expertise related to the challenge problem in sessions presented by faculty and graduate students
- Team members bring all this information and expertise to the problem at hand
- Teams present their understanding and results in variety of settings

Role of the Graduate Student Coordinating the High School Program
- Help design the materials for teacher’s workshops, professional development for teachers as well as pre-challenge materials for students
- Provide needed content and expertise to support teaching oceans science
- Recruit partners and participants for the teachers’ workshops as well as challenge
- Gain experience working with the SMILE Program model, with public school teachers
- Learn methods to engage both students and adults in ocean sciences

Students get advice from experts on how to use satellite data to narrow the search for a missing research vessel at the 2007 Challenge.
High School Program Evaluation

The SMILE High School program is continuously evaluated in a number of formal and informal ways throughout the planning and delivery process. The program model is applied to a specific content area and then evaluated by the public school teachers who serve as SMILE club advisors, the SMILE club members who participate in the challenge, and the partners who support the challenge. Components of program evaluation include:

- Club materials designed to prepare the students are delivered at teacher’s workshops and the SMILE Club advisors evaluate these workshops.
- Conversations about programming and overall partnership goals and methods take place as part of the teachers’ workshops.
- Materials are further evaluated on the quality and applicability of these materials in the club setting as part of club reporting.
- The High School Challenge is formally evaluated by the participants and teachers, by the college student mentors, and the programming faculty of the SMILE Program.
- End of the year evaluations go out to teachers, club members and their families with questions about the overall utility of club and special events participation.
- The May Teachers’ Workshop includes an evaluative conversation with the high school teachers soliciting improvements for club materials and challenge activities, as well as topics of interest to the teachers and their students.

The SMILE programming team has ongoing conversations (daily to weekly) throughout the year about these evaluation results as they relate to program models and delivery. The team also shares these evaluations with the program partners who fund and/or support the Teacher’s Workshop, club materials, and the High School Challenge.

For more information about The SMILE Program, contact SMILE’s director, Eda Davis-Butts, at eda.davisbutts@smile.oregonstate.edu.

The SMILE Program

http://smile.oregonstate.edu/