Considering a Career in Ocean Science?

A Classroom Activity for Ocean Gazing Episodes 9, 27, & 35: The ocean as classroom; Bobbing and bowling; Accentuate the positive

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Introduction

The Ocean Gazing episode entitled "The Ocean as a Classroom" features interviews with Janice McDonnell and Jim Yoder discussing their motivations for joining the professional world of ocean sciences, and how COSEE (Centers for Ocean Sciences Education Excellence) motivates others to feel connected with the ocean. In the episode "Accentuate the positive," children from New Jersey discuss their career aspirations, some of which include science.

The following information and web links provide support for students potentially interested in pursuing a career in the ocean sciences.

Background Information

1) *Need for STEM professionals*.

The importance of science and engineering to the U.S. has been documented in a series of reports for over half a century. Nevertheless, critical issues for the nation's science and engineering infrastructure remain unsettled. Among them, America faces a demographic challenge with regards to its science and engineering workforce: minorities are seriously underrepresented in science and engineering, yet they are also the most rapidly growing segment of the population.

The United States stands again at the crossroads: a national effort to sustain and strengthen science and engineering must also include a strategy for ensuring that we draw on the minds and talents of all Americans.

The science and engineering workforce is large and fast-growing: more than 5 million strong and projected by the U.S. Bureau of Labor Statistics to grow faster than any other sector in coming years. This growth rate provides an opportunity to draw on new sources of talent, including underrepresented minorities, to make our science and engineering workforce as robust and dynamic as possible. (*Rising Above the Gathering Storm*, *National Academies of Sciences*, 2005)

2) *Preparation of STEM Professionals*.

Education is an Asset: Improving the education of our citizens, especially in science and engineering, has further

benefits to society:

a. a citizenry better educated in science and engineering strengthens democracy and informed participation in a world in which STEM is more important than ever to policy;
b. minority communities with greater access to experts who understand science and engineering problems (e.g. water quality and toxic waste dumps) and policy choices for them will be stronger;
c. STEM-educated workers will be better able to perform in environments characterized by risk and complexity.

(*Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads*, *National Academies*, 2011)

Information is Critical: The Spellings Commission focused in this regard on college awareness activities during high school, noting that "many students and parents don't understand the steps needed to prepare for college" and "there need to be programs that provide resources for early and ongoing college awareness activities that show the benefits of college, career exploration, academic support, college planning, financial aid application assistance)." (*A Test of Leadership: Charting the Future of U.S. Higher Education (Spellings Commission)*, *U.S. Department of Education*, 2006)

3) Proper preparation

Algebra is a "gatekeeper" subject: students who don't do well in Algebra or who don't take it have precluded their career options in a variety of jobs related to science, technology, engineering, and mathematics. There are a variety of studies that have linked success in algebra to future educational and career opportunities. For example, completing a mathematics course beyond Algebra II in high school more than doubles the odds that a student who enters college will complete a bachelor's degree. Another study found more than three-quarters of students who took Algebra I and Geometry went on to college within two years of high school graduation, while only one-third of students who did not take Algebra I and Geometry courses did so. (Chris Dede, Ed., Harvard Graduate School of Education, 2010)

Informational Reports about Sensor Networks

1) Sensors for Environmental Observatories (National Science Foundation Report) http://www.wtec.org/seo/final/Sensors_for_Environmental_Observatories.pdf

2) Sensor Revolution (National Science Foundation Special Report) http://www.nsf.gov/news/special_reports/sensor/index.jsp

Environmental Observatories and the Need for Workforce

In the 1980s, the personal computer revolution placed computing at the average citizen's fingertips. In the 1990s, the internet revolution provided connections with an information web that spans the planet. This decade ushered in the next revolution—the sensor revolution. This latest use of technology is connecting the internet to the physical world, creating the world's first electronic nervous system (NSF, 2005).

The science and engineering communities, with the support of the National Science Foundation and other agencies, have successfully conceived, designed, and begun

implementing several new environmental observing systems that will provide data products and enable longer-term sensing of the environment. The installation and use of environmental observatories is transforming the way scientific research is conducted, a paradigm shift from discrete sampling to continuous, in-situ sampling. Environmental observatories will enable an accelerated accumulation of baseline data, create a more robust database for improved investigations and models, and enable continuous sampling during episodic events.

However, there are significant limitations to current sensor technology and the environmental observation networks that collect data, clearly demonstrating the need for:

- ✓ The development of new types of sensors and sensors with new capabilities;
- ✓ The ability to link sensors to a broader network;
- ✓ Coordination across various environmental observatories;
- ✓ Capabilities for long-term autonomous deployment and maintenance; and
- ✓ A *new mechanism to educate* researchers, technicians, and the general public on new sensor and sensor network technologies (Sensors for Environmental Observatories, NSF 2006).

The education of the 21st century environmental technology workforce demands an understanding of environmental sciences and other disciplines, an ability to resolve complex environmental issues, and the ability to communicate complex ideas to a broad audience. Fostering these critical abilities will require a new set of learning opportunities. Developing and maintaining such a workforce will rely on innovative educational programs that prepare future sensor technology workforce professionals at a variety of levels and in a variety of environmental field. Proper leverage of information technology (IT)-enabled systems, tools, and services will be critical for addressing these training needs, having a profound impact on the practice of science and assessment, engineering research, industry, and global citizenry. However, the multidisciplinary, technology-based approach needed to ensure workforce preparedness is not always reflected in our educational programs.

SENSE IT provides students with the opportunity to learn the engineering design process through the construction, programming, deployment and testing of a student-implemented water monitoring network. The sensor development phase and analysis of sensor data requires students to apply several STEM principles showing students how their skills can be used to solve real-life problems within the context of an environmental monitoring project. The project emphasizes the pedagogical approach of project-based learning and collaborative teamwork, and gives students practical experience in systems thinking.

Large scale environmental observatories under development

- ✓ Ocean Observatories Initiative (OOI) http://www.oceanobservatories.org/
- ✓ Integrated Ocean Observing Systems (IOOS) http://www.ioos.gov/
- ✓ National Ecological Observatory Network (NEON) http://www.neoninc.org/
- ✓ Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI) http://www.cuahsi.org/

- ✓ Arctic Observing Network (AON) http://www.aoncadis.org/
- ✓ Earthscope http://www.earthscope.org/
- ✓ Long Term Ecological Research Network (LTER) http://www.lternet.edu/

Careers Involved with the Operation of an Environmental Observatory (Annotated List)

- ✓ Computer scientists
- ✓ Software engineers (sample job description)
- ✓ Data managers
- ✓ Data visualization programmers (sample job description)
- ✓ Environmental science
  - oceanographer (sample job description)
  - meteorologist
  - climatologist
  - microbiologist
  - hydrologist
  - chemist
  - biologist
  - physicist
- ✓ Field deployment managers (sample job description)
- ✓ Aquatic instrument Engineers/scientists (sample job description)
- ✓ Environmental engineers (sample job description)
- ✓ Technicians
- ✓ Satellite technicians (sample job description)
- ✓ Radar technicians
- ✓ Web designers
- ✓ Graphic designer (sample job description)

Career Information

- ✓ OceanCareers.com http://oceancareers.com/2.0/index.php
- ✓ Higher Education Guide to Marine Science and Technology Programs https://www.mtsociety.org/publications/higherguide.aspx
- ✓ NOAA Ocean Explorer http://oceanexplorer.noaa.gov/edu/oceanage/welcome.html
- ✓ ASLO – Working in the Aquatic Sciences http://www.aslo.org/career/aquaticcareer.html
- ✓ Science in Public Policy http://www.aslo.org/policy/policycareer.html

Professional Societies

Identify and contact the professional societies representing the field of interest – many have scholarship opportunities, internship opportunities, mentoring programs, and overall guidance as to how best to enter the particular field of interest.

- ✓ Marine Technology Society - MTS https://www.mtsociety.org/education/
- ✓ American Society of Limnology and Oceanography – ASLO http://www.aslo.org/employment/studentops.html
- ✓ Society for the Advancement of Hispanics/Chicanos and Native Americans in Science – SACNAS http://sacnas.org/students
- ✓ Institute of Electrical and Electronics Engineers - IEEE http://www.ieee.org/education_careers/index.html
- ✓ The Oceanography Society - TOS http://www.tos.org/

Funding for College

Student Loans, Financial Aid, and Scholarships

- ✓ Free Application for Federal Student Aid (FAFSA) http://www.fafsa.ed.gov/

- ✓ Find Aid
  http://www2.ed.gov/finaid/landing.jhtml?src=ln
  If you're exploring options for paying for college, you'll learn about the various kinds of financial aid (loans, grants, and work-study), how to apply, common myths, and more.
- ✓ College Board – Pay for college
  http://www.collegeboard.com/student/pay/

Understand all of your options when it comes to paying for college. This web site contains the latest information about college costs, scholarships, financial aid applications, education loans and college financing.

Look for schools with scholarships in your field of interest:

Science, Technology, Engineering, and Mathematics (S-STEM): This National Science Foundation program makes grants to institutions of higher education to support scholarships for academically talented, financially needy students, enabling them to enter the workforce following completion of an associate; baccalaureate; or graduate-level degree in science and engineering disciplines. Grantee institutions are responsible for selecting scholarship recipients, reporting demographic information about student scholars, and managing the S-STEM project at the institution. *The program does not make scholarship awards directly to students; students should contact the institution's Office of Financial Aid for this and other scholarship opportunities.*

Science, Technology, Engineering, and Mathematics Talent Expansion Program (STEP): The Science, Technology, Engineering, and Mathematics Talent Expansion Program (STEP) seeks to increase the number of students (U.S. citizens or permanent residents) receiving associate or baccalaureate degrees in established or emerging fields within science, technology, engineering, and mathematics (STEM).

This National Science Foundation program provides educational opportunities for Undergraduate students . This program supports institutions which may provide support to individuals at those institutions. To inquire about opportunities in this program, contact one of the awarded institutions, available by clicking on the Awards link:
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5488

Federal Cyber Service: Scholarship for Service (SFS): The Federal Cyber Service: Scholarship for Service (SFS) program seeks to increase the number of qualified students entering the fields of information assurance and computer security and to increase the capacity of the United States higher education enterprise to continue to produce professionals in these fields to meet the needs of our increasingly technological society.

This program provides educational opportunities for Undergraduate Students, Graduate Students. This program supports institutions which may provide support to individuals at those institutions. To inquire about opportunities in this program, contact one of the awarded institutions, available by clicking on the Awards link:
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5228

Louis Stokes Alliances for Minority Participation (LSAMP): This program is aimed at increasing the quality and quantity of students successfully completing science,

technology, engineering and mathematics (STEM) baccalaureate degree programs, and increasing the number of students interested in, academically qualified for and matriculated into programs of graduate study. LSAMP supports sustained and comprehensive approaches that facilitate achievement of the long-term goal of increasing the number of students who earn doctorates in STEM fields, particularly those from populations underrepresented in STEM fields.

Pathways to Science:
PathwaysToScience.org is a portal website supporting pathways to the STEM fields: science, technology, engineering, and mathematics. Particular emphasis is placed on connecting traditionally underrepresented groups with STEM programs and resources, including funding and mentoring opportunities.
http://www.pathwaystoscience.org/lsamp.asp?sort=region&subsort=Southeast

Academic Competitiveness Grant (ACG) Program:
http://www.studentaid.ed.gov/PORTALSWebApp/students/english/AcademicGrants.jsp
An Academic Competitiveness Grant provides $750 for the first year of study and $1,300 for the second year. Note: The amount of the ACG, when combined with a Pell Grant, may not exceed the student's cost of attendance. In addition, if the number of eligible students is large enough that payment of the full grant amounts would exceed the program appropriation in any fiscal year, then the amount of the grant to each eligible student may be ratably reduced.

National Science and Mathematics Access to Retain Talent Grant (National SMART Grant) Program:
http://www.studentaid.ed.gov/PORTALSWebApp/students/english/SmartGrants.jsp
The National Science and Mathematics Access to Retain Talent Grant, also known as the National Smart Grant is available during the third and fourth years of undergraduate study (or fifth year of a five-year program) to at least half-time students who are eligible for the Federal Pell Grant and who are majoring in physical, life, or computer sciences, mathematics, technology, engineering or a critical foreign language; or non-major single liberal arts programs. The student must also maintain a cumulative grade point average (GPA) of at least 3.0 in course work required for the major. The National SMART Grant award is in addition to the student's Pell Grant award.

A National SMART Grant will provide up to $4,000 for each of the third and fourth years of undergraduate study. The amount of the SMART Grant, when combined with a Pell Grant, may not exceed the student's cost of attendance. In addition, if the number of eligible students is large enough that payment of the full grant amounts would exceed the program appropriation in any fiscal year, then the amount of the grant to each eligible student may be ratably reduced.

Research Experience for Undergraduates (REU): The Research Experiences for Undergraduates (REU) program supports active research participation by undergraduate students in any of the areas of research funded by the National Science Foundation. REU projects involve students in meaningful ways in ongoing research programs or in research projects specifically designed for the REU program. REU Sites are based on independent proposals to the National Science Foundation to initiate and conduct projects that engage a number of students in research. REU Sites may be based in a

single discipline or academic department, or on interdisciplinary or multi-department research opportunities with a coherent intellectual theme. Proposals with an international dimension are welcome. A partnership with the Department of Defense supports REU Sites in DoD-relevant research areas.

Undergraduate student participants must be citizens or permanent residents of the United States or its possessions.

Students may not apply to NSF to participate in REU activities. Students apply directly to REU Sites and should consult the directory of active REU Sites: http://www.nsf.gov/crssprgm/reu/reu_search.cfm

National Institutes of Health, Bridges to the Baccalaureate:
http://www.nigms.nih.gov/Research/Mechanisms/BridgesBaccalaureate.htm
The Bridges to the Baccalaureate Program provides support to institutions to help students make transitions at a critical stage in their development as scientists. The program is aimed at helping students make the transition from 2-year junior or community colleges to full 4-year baccalaureate programs. The program targets students from groups underrepresented in the biomedical and behavioral research enterprise of the nation and/or populations disproportionately affected by health disparities (targeted groups).

The Bridges to the Baccalaureate Program promotes institutional partnerships between community colleges or other 2-year post-secondary educational institutions granting the associate degree and colleges or universities that offer the baccalaureate degree. The partnership/consortium must involve at least two colleges or universities but no more than four institutions, including the applicant institution, unless strongly justified. The bachelor's degree-granting institution(s) in the consortium must have a strong science curricula and a track record of enrolling, retaining and graduating students who pursue advanced degrees in biomedical and behavioral research fields. Community colleges and other 2-year post-secondary educational institutions in the consortium must offer associate degree programs with an emphasis on the biomedical and behavioral sciences and must have a high enrollment, as determined by the applicant institution, of students from targeted groups.

Bridges to the Baccalaureate Degree Participating Institutions:
http://www.nigms.nih.gov/Minority/Bridges/PartInstBacc.htm

National Institutes of Health, MARC Undergraduate Student training in Academic Research (U*STAR): MARC U-STAR:
http://www.nigms.nih.gov/Training/MARC/USTARAwards.htm
MARC U-STAR awards provide support for undergraduate students who are underrepresented in the biomedical and behavioral sciences to improve their preparation for high-caliber graduate training at the Ph.D. level. The program also supports efforts to strengthen the science course curricula, pedagogical skills of faculty and biomedical research training at institutions with significant enrollments of students from underrepresented groups.

Local Community Scholarships:
Several local businesses and organizations offer scholarships for students pursuing STEM careers. Ask your Guidance Counselor or search local organizations for opportunities.

Community College and Technical Schools are wonderful options for students. High school students can often college courses while still in high school and accrue college credit.

- ✓ Reasonably priced
- ✓ Focus on teaching/hands-on learning
- ✓ Often smaller classes

The Advanced Technology Education (ATE) Program from NSF funds technology education programs at various Community Colleges throughout the US, please refer to the ATE Network's web site for detailed information about the programs: http://atecentral.net/

Military: Entering the military can offer students a variety of STEM career options:

- ✓ Enlisting – Post basic training assignments
- ✓ College preparatory – West Point, Annapolis, Air Force Academy, etc.
- ✓ Graduate School - Naval Post Graduate School, etc
- ✓ Service members Opportunity College http://www.soc.aascu.org/
- ✓ K-12 outreach: Office of Naval Research (ONR) http://www.stem2stern.org/index

Sources

The related podcast episode for this activity can be found by going to the podcast section of www.oceangazing.org