

IN THE OCEANOGRAPHY CLASSROOM

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WHEN WILL YOU SPEAK OUT FOR OCEAN SCIENCES EDUCATION?

Ocean sciences educators are restless. For years since the publication of the *Benchmarks for Science Literacy* and the *National Science Education Standards for K-12* and the *Shaping the Future* report for undergraduate education, we have made slow progress in reforming ocean sciences education, as though pulling a becalmed ship. Now a breeze freshens with coordinated opportunities for reform. But we are also set to sail toward greater challenges. Now is the time for greater effort, for more voices to speak out for ocean sciences education.

Most of the voices we hear are administrators' voices. Even so, more administrators should join in, for it is administrators who inform us of institutional perspectives and policy issues. But administrators should not be the only voices heard. In my experience, too many administrators are too far removed from the classroom, the students, and the nature of reform. Given their other responsibilities, it is understandable that so many of them are disconnected from the students. We need to hear more voices from the classroom. For it is the teachers and students whose sweat will make a reality of these grand opportunities for education reform. Let's look at a few of the challenges and the opportunities to address them.

K-12 Education. The starkest challenge facing us in K-12 ocean sciences education is stated succinctly in the *Blueprint for Change: Report of the National Conference on the Revolution in Earth and Space Science Education* (2002): "only 7% of the nation's high school students take earth and space science—as opposed to 88% that take biology." And, of course, learning about the ocean is only a part of the earth sciences curriculum. We simply are not reaching very many high school students. But grand opportunities to reach them are our fair wind.

One opportunity is the Centers for Ocean Sciences Education Excellence (COSEE), funded by the National Science Foundation (NSF) Division of Ocean Sciences (OCE). At the time of this writing, however, no information about these centers is available on the OCE Web site. Because the selection of the sites was by proposals, we shall not know what COSEE intends to do until the plans in the winning proposals are posted. Then we need to hear COSEE's voices. Another oppor-

tunity is the Revolution in Earth and Space Science Education previously mentioned <www.EarthScienceEdRevolution.org/>. This is a grassroots movement, in which you can participate and represent ocean sciences education. It recommends, among other actions, the establishment of state-based alliances to promote earth and space science education reform. Such alliances have been successfully established in the field of geography. Nevertheless, they are not a simple solution. In 2001, the U.S. Department of Education's National Assessment of Educational Progress report on geography education noted that, despite the alliances: 1) there was no change between 1994 and 2001 in the number of students rated at least "proficient" in knowledge of geography, and 2) the number was only 20 to 30% of the students, depending on the grade.

Another challenge is the removal of earth sciences, and hence ocean sciences, education from the K-12 curriculum. This unbelievable decision was made in 1999 by the Texas State Board of Education in response to a new law that included the requirement of only biology and integrated physics and chemistry in the exit science exam for graduation. In 2002 the California State Board of Education decided that a lab course in earth sciences was not acceptable as a core science course for graduation. Both state actions rendered earth sciences pointless for graduation. A coordinated effort by earth scientists in Texas has made some progress in changing the situation there, but as far as I know, efforts in California have not been successful. Although our colleagues in other states have also fought the removal of earth sciences from the curriculum, California and Texas are especially critical because 20% of the K-12 students in the nation are enrolled in those two states. We need to hear what is happening in our own state, even our own school district. For if the earth sciences are not part of a standardized test, then they will not contribute data on which a superintendent's schools will be evaluated. So, need they be taught? Whose voices will tell us what is happening? Who is making the case for the importance of earth sciences in the K-12 curriculum?

Undergraduate Education. The big challenge to undergraduate education comes in two parts. The first is the sheer number of students coming along. Depending on assumptions, the National Center for

Education Statistics predicts the undergraduate enrollment in degree-granting institutions by 2011 will increase between 17 and 24% over the number in 1999. Over 75% of undergraduate students today attend public institutions. Is state funding going to increase 17 to 24%, or will classes simply be made even larger? Or will instructional technology finally succeed? We are fortunate in the earth sciences to have a young but excellent digital library, the Digital Library for Earth System Education (DLESE) <www.dlese.org/>. Here is another grassroots opportunity. Contributors and users are working together to develop a library of electronic educational materials and services for teachers and students studying all aspects of the Earth, at all educational levels. There are several ways for you to become involved. We need to hear from those already involved.

A separate challenge, which is concealed in the increased number of students, is the changing demographics of the students. Not only are women, many of whom are *well-prepared* for college, a growing majority of the undergraduate enrollment—indeed, some colleges are now actively recruiting men in an attempt to balance the numbers—but the number of students of color is increasing rapidly. In the United States, according to the Department of Education, between 1997 and 1999 the percentage rate of increase in number of students of color was an order of magnitude greater than that of white students. That rate differential will continue. Data analysis by the Educational Testing Service suggests that three-fourths of the additional undergraduate students between now and 2011 will be students of color. But underrepresented populations have always had inadequate learning opportunities and poor opportunities to prepare for advancement. Many of these students will be first-generation college students in an alien environment. And they will be clustered in particular geographic regions.

Even today serious concerns exist about students' preparation for college. A National Science Board survey in 2000 reported that two-thirds of undergraduate faculty rated the math skills of freshmen and sophomores as merely "fair" or "poor"; 80% rated the writing skills that low; and employers' ratings of recent employees were similar. The Fall 2001 survey by the Higher Education Research Institute of the attitudes and characteristics of 281,000 freshmen entering four-year colleges reported that many students enter college with little inclination to study but with expectations for good grades—a combination of attitudes that spells trouble with a capital "T." Furthermore, several national and local surveys record the large number of undergraduate students who work and the inverse relationship between hours worked per week and level of academic achievement.

All these factors combined create a major teaching challenge for undergraduate faculty, not just in ocean sciences, but in all fields. Some faculties will arise to the

challenge proactively, and some administrators will display the leadership stressed by the esteemed educator Parker Palmer: "offering people excuses and permissions to do things that they want to do but cannot initiate themselves." A fair wind of opportunities is blowing. For years, the NSF Division of Undergraduate Education has lamented the paucity of proposals from oceanographers. The Department of Education Fund for the Improvement of Postsecondary Education's (FIPSE) Comprehensive Program has funded undergraduate education reform projects that are innovative and collaborative, have evaluation, and disseminate the results. FIPSE supports "reform in the midst of a changing world." Here are two grand opportunities, particularly when combined with the increasing national demand that future high school teachers major or minor in the science they will teach.

Graduate Education. The principal challenge in graduate education is the reform of doctoral education. The Re-envisioning the Ph.D. Project <www.grad.washington.edu/envision/index.html> has, among other accomplishments, compiled national recommendations for doctoral education reform from key stakeholders: research- and teaching-intensive institutions, doctoral students, government agencies that fund or hire doctoral recipients, business and industry, private foundations, disciplinary societies, and education associations. But none of the 151 organizations, institutions, corporations, and agencies represented at the April 2000 conference was primarily representing earth sciences. Nor are the earth sciences represented among the disciplines for the follow-on program of the Carnegie Foundation. Under the leadership of the Woodrow Wilson National Fellowship Foundation <www.woodrow.org/responsivephd/> a model for innovation and change in doctoral education is being developed for testing with the collaboration of 14 major Ph.D.-granting universities, but only one of these universities is a leader in ocean sciences education. Ocean sciences education should have a voice in this discussion. Here is a grand opportunity to improve doctoral education in our discipline.

It is time to hear more voices speak out for ocean sciences education, recommending, explaining, reporting how we can enhance education at each level, how we *are* enhancing it, how we *have* enhanced it. Will your voice be one of them? A new voyage of reform is beginning. Will you sail on it? I hope so, but it will have to be without me. I am retired now. In fact, this is my last column. I thank Rick Spinrad deeply for giving me the opportunity to share my opinions with you. It was an honor and a great pleasure. And I thank you for reading these words. To all ocean sciences educators sailing on before these grand opportunities, I shall borrow from Goethe's poem and wish you a "prosperous voyage." 