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A look at the sedimentary record in northern Ethiopia tells the story of oceans past—and maybe future.
Two- and Four-Year Colleges Team Up to Support Science Students

By Janet Hodder, R. Heather Macdonald, and Jude K. Apple
Much has been written about how the United States faces a shortage of science, technology, engineering, and mathematics (STEM) professionals despite the national goal to provide 1 million additional STEM degrees by 2022 [e.g., President’s Council of Advisors on Science and Technology, 2012]. What is not immediately clear, however, are the steps educators need to take to overcome the shortage and meet that goal.

The success of several new projects suggests that 2-year colleges, community colleges, technical colleges, and junior colleges (collectively 2YC)—a group new to the STEM reform movement—can help lead students into career pathways involving science and math [Boggs, 2010, National Academy of Engineering and National Research Council, 2012]. In turn, these projects have increased awareness among professional societies and staff at 4-year colleges and universities (4YCU) about the importance of 2YC in the preparation of students for STEM careers.

Some 4YCU faculty, particularly those who did not attend a 2YC as part of their education, may be unfamiliar with the culture, needs, and realities of the 2YC faculty and their students. Here we provide insights into the community colleges’ missions, students, faculty, and curriculum and present specific strategies to promote successful partnerships between 2YC and 4YCU faculty and institutions. In doing so, we hope to assist the growing number of 4YCU faculty who desire to partner with 2YC faculty to improve STEM education and achieve a broader impact for their disciplinary research.

Profile of Community Colleges

1132 public and private community colleges in the United States play a crucial role in undergraduate STEM education. They enroll 12.8 million students annually, approximately 45% of all U.S. undergraduates [American Association of Community Colleges, 2014] (See box on page 10).

Nearly one half of Americans who receive bachelor’s degrees in science and engineering and one third of recipients of science or engineering master’s degrees attended a community college at some point in their education [Tsapogas, 2004]. Community colleges are also important for teacher preparation, with 40% of the nation’s teachers—including those in STEM fields—completing some of their mathematics or science courses at community colleges [Shkodrani, 2004].

Community colleges are diverse in size and location, ranging from multicampus districts in large urban settings to small, rural colleges in remote areas. Their departmental and governance structures vary within and among states.

Teaching at a Community College

Teaching is the primary responsibility for 2YC faculty (see box on page 11), and thus their reward structure is often different from those at many 4YCU. Generally, research in their discipline is not expected, it may even be discouraged because it could interfere with time dedicated to...
Heavy teaching loads mean that 2-year college faculty may find it difficult to engage in activities beyond their instructional duties.
allows them to contribute to project planning. One perception, based on the experience of many 2YC faculty with whom we have worked, is that they are included in many projects as a token, as an afterthought, or only as a way to boost the possibility of obtaining funding.

**Understand the institutional mission, policies, and the true capacity of the partner 2YC.**

Some 2YCs do not have a grants office and may have limited support for administrative functions related to external funding. Timing of activities related to the proposed project may need to fit the often more constrained 2YC schedule. Some 2YC faculty will have difficulty leaving their institution during the academic year and may need to provide replacement instruction, sometimes from their own resources, because they cannot cancel classes.

**Be aware of the target student’s profile and the 2YC’s profile.**

Projects that involve students need to take into account student needs and constraints (e.g., families, jobs; barriers to moving that prevent, say, participation in off-campus internships), the assets they bring (e.g., life experiences, strong community ties), and the culture of a 2YC.

For example, in developing the COSEE Promoting Research Investigations in the Marine Environment (PRIME) internship program (http://www.coseepacificpartnerships.org/programs/CC/students/), which provides 2YC students with a summer research opportunity at a marine laboratory, we had to work with 2YC faculty to identify students who would benefit from this early-career research internship. Without faculty intervention, 2YC students rarely consider applying for summer research experiences because they do not see themselves as being qualified for these opportunities.

The more diverse nature of the 2YC student body makes it necessary for program developers to think beyond the needs of the 18- to 22-year-old student cohort. For example, projects involving, say, fieldwork may need to provide accommodations for accompanying family members or may need to connect participants with child-care options. Projects could also follow the example of AGU’s Unique Research Experiences for
Students
Thirty-six percent of 2YC students are first-generation college students [American Association of Community Colleges, 2014], many of whom have limited knowledge of what is required for success in higher education. Open admission policies mean that some students need developmental courses to prepare for college-level work. Many 2YC students have constraints on participation in extracurricular activities because they may be place bound or juggling employment and childcare.

The open admission policy at most 2YCs results in a student body that is generally more diverse, in many measures, than that of a 4YCU. A higher percentage of minorities underrepresented in the STEM fields attend 2YCs than 4YCUs. Nationally, 59% of Native American, 56% of Hispanic, and 48% of black undergraduates are enrolled in 2YCs.

The average 2YC student is a 28-year-old woman in a class that is 57% female; she is attending college part time, along with 60% of her classmates, and is working full or part time, along with 68% of her fellow students. Her tuition is considerably lower than that at most 4-year institutions, and she, along with 58% of her classmates, is receiving some type of financial aid [American Association of Community Colleges, 2014].

The Need for More Partnerships
Four-year institutions and faculty have only just started to play a significant role in partnering with community colleges to increase the capacity of both types of institution to support undergraduate engagement in STEM. In the geosciences, we have only just begun to see if these efforts will pay off.

Qualitatively, 2YC faculty who have participated in partnership projects reported increased student learning gains and engagement in their geoscience courses, although very few studies have measured whether interest in STEM persists through the students’ lives. Nonetheless, an evaluation of 2YC students who participated in the COSEE internship program supports the idea that undergraduate research attracts and retains talented students to careers in science [Lopatto, 2007]: Compared with the “average” community college student who transferred to a 4-year institution, the interns...
demonstrated a high persistence and success in STEM postsecondary education.

The most transformative projects will likely be those that specifically offer professional development for 2YC faculty, improve STEM education of 2YC students, provide research opportunities for 2YC faculty and students, and increase 2YC student transfer success rates to 4YCs. More projects that focus on 2YC faculty and students should provide us with information on successful strategies for broadening the diversity of the geoscience workforce and recruiting more students into STEM careers.

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Faculty
One distinctive feature of 2YCs is the makeup of the faculty. Nationally, 68% of faculty members in the 976 public community colleges in the United States are part time [Knapp et al., 2012]. From 2003 to 2009, the number of part-time faculty increased by about 10%, whereas the number of full-time faculty grew by only 2% [Knapp et al., 2010]. The number of permanent full-time faculty who teach STEM subjects at 2YCs varies by institution. Some are tenured or tenure eligible; however, some states (e.g., Texas) have no tenure system, and permanent, full-time faculty are employed on multiyear contracts.

Faculty titles at 2YCs are not always consistent with those at 4YCs. Although some systems have assistant, associate, and full professors, others use terms such as “lecturer” for full-time permanent faculty. In STEM fields, 22% of full-time 2YC faculty have doctorates and 62% have master’s degrees, compared with 12% and 51% of part-time faculty, respectively [American Association of Community Colleges, 2014].

Some faculty members at 2YCs are nonacademic professionals who teach specialized courses associated with certificate or applied associate degree programs. At many institutions, adjunct or contingent faculty who are commonly employed on a year-to-year or term-to-term basis do the majority of the teaching.

These full-time or part-time adjunct faculty members are diverse and include graduate students who want to gain teaching experience, people attempting to secure permanent positions in academia who may teach several courses each term at multiple institutions, and people with specific technical knowledge who teach a single course at one institution. Some 2YC faculty members, whether by choice or circumstances, spend their entire career in adjunct positions.

One notable feature of having regular and adjunct faculty is the disparity in pay and benefits between the two. Many adjuncts are paid by the course. The median pay for a three-credit course taught by a 2YC adjunct faculty member in fall 2010 was US$2235 [Coalition on the Academic Workforce, 2012]. In addition, adjuncts do not typically have access to professional development opportunities or discretionary funds, rarely participate in institutional governance, and may not even be listed on the college website.

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