

Combining Research, Outreach and Student Learning

A New Model in Rhode Island

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American research universities are renowned for applying cutting-edge science to the improvement of the world's health and environmental systems. Indeed, as a society, we have come to expect this type of intellectual leadership from our great universities. Less appreciated is the robust opportunity for state and local governments to harness the intellectual power of the academy to help solve community problems.

Yet these kinds of partnerships are particularly strong at the nation's land-grant and sea-grant institutions, where federal investment over the past century-and-a-half has generated innovative solutions to problems at the local, state, regional and national levels.

Typically, this university research and resulting outreach unfolds in dedicated scientific settings that are removed from another of the university's primary missions—the education of future problem-solvers. Yet the implementation of scientific solutions to some of our most complex environmental and human problems requires colleges and universities to face the important and challenging task of preparing undergraduate students to be expert problem-solvers, adept at addressing emerging issues and implementing programs that draw on a range of disciplines and technologies. Complex contemporary problems demand nothing less.

Traditional universities are well-equipped to educate students in classrooms about scientific problems that are already understood and solved. They are less prepared to introduce students to the complexity and challenge of emerging scientific problems. This frontier of discovery and excitement exists in the university's

research laboratories and in its outreach settings, but it rarely spills over into the classroom perhaps a few-hundred feet down the hall. The challenge is clear. If we are to prepare students with a full range of skills and a passion for learning, we must expose them to both worlds. In the American educational landscape, research universities have the capacity to offer a unique form of education by melding their research and outreach missions with their teaching mandate. (In fact, these imperatives are echoed in two national reports on American research universities: the Carnegie Commission on Educating Undergraduates in the Research University's *Reinventing Undergraduate Education: A Blueprint for American's Research Universities* of 1998, and the Kellogg Commission on the Future of State and Land-Grant Universities' *The Engaged Institution* of 1999.)

Shift to learning

Since his arrival at the University of Rhode Island in 1991, President Robert Carothers has sought to shift the focus of the undergraduate experience from teaching to learning. He has initiated institutional self-examination to identify URI's engines of research excellence and encourage faculty and departments to weave student learning into those fields. This has resulted in an effective approach to community-based outreach and to student learning at URI.

One of URI's successes in fostering active learning has been in the area of marine and environmental science. Over the past five years, the URI Coastal Fellows Program has provided capstone experiential learning for more than 265 students in various scientific disciplines and attracted more than \$1 million in outside funding to URI. The program infuses externally funded research teams of faculty, staff and partners with the principles of undergraduate experiential learning.

Coastal Fellows range from sophomores to seniors. They are formally assigned to work for at least eight months within a vertically integrated research or outreach team. After learning about the dimension of a



PHOTO BY ROMY FERENBAUGH.

Technical expertise. Susan Baxter, a Coastal Fellow with the URI Environmental Data Center, digitizing maps for the National Park Service in 1999.



Spreading knowledge. Coastal Fellow Linda Green training a volunteer to monitor the ponds of Rhode Island for water clarity and nutrients.

particular research or management initiative, students begin to work on an aspect of the team's investigation, for which the student accepts primary responsibility. Fellows are supported in their work and learning by other members of their team, usually a mix of faculty, more senior research or outreach staff, postdoctoral fellows, graduate students and senior undergraduate fellows. Research funding is obtained through competitive, peer-reviewed processes.

Most of the research teams are multigenerational, with the capacity to embrace and nurture students throughout their education. These teams offer students a range of learning experiences and project-related support. Among the most valuable benefits to students is the informal learning that takes place in the teams—the networking and casual reflection, but also the conversations that help them acquire the language of their discipline and, thus, a professional voice. At the conclusion of their fellowship, students present their findings to an assembly of fellows, mentors, other university faculty and staff, partners from external agencies and the university's provost and president. Coastal Fellows receive a summer stipend and academic credit for their work.

This model provides a powerful forum for undergraduate learning, particularly when set in the context of applied community problem-solving. As a junior, Ben Galuardi worked with state officials and coastal zone managers at the URI Coastal Resources Center to research and draft natural hazard mitigation strategies for Rhode Island. This plan was presented to the state

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and later published. Galuardi says the fellowship allowed him "to give something to the community."

In the early 1990s, the City of Warwick, R.I., began a substantial initiative to improve its water quality and restore the shellfishing industry of Greenwich Bay — a central feature of the city's economy and heritage. In response to discussions between Warwick Planner Jonathan Edwards and URI's Peter August, an expert in the development of computerized mapping from remotely sensed data, Warwick funded three Coastal Fellows to develop a digital, high-resolution spatial database of the coastal lands in the town. The Coastal Fellows, in conjunction with August's staff at the URI Environmental Data Center, played a key role in helping the city prioritize its investments in septic and sewer infrastructure to improve water quality.

Another longstanding Coastal Fellow project has united a local community in its efforts to preserve open space for future generations. Coastal Fellows have been selected by the Town of Richmond to work in conjunction with Stephen Swallow, a renowned URI researcher in the field of survey-based valuation methods, and Richmond Town Planner Joe Lombardo to assess the commitment of the community to fund preservation of open-space initiatives. Over a four-year period, the town has funded three undergraduate Coastal Fellows to apply the results from a public preference economic model to identify and prioritize land parcels for conservation. These results provide key information to the town's Rural Preservation Land Trust and have been instrumental in helping balance economic growth while preserving the rural character of the community. Moreover, town staffing is limited, and the work wouldn't have been done if not for the Coastal Fellows.

The Coastal Fellows Program has generated a burst of enthusiasm on campus and contributed to a marked attitudinal change toward undergraduate education among research faculty and staff at URI. In particular, the program has bridged the gulf that separated graduate faculty, outreach educators and research professors from undergraduate learning. Many local communities and state and federal agencies have recognized the power of this connection to access nationally renowned research and outreach programs at URI to meet their own local needs. They regularly utilize Coastal Fellows, supervised and mentored by a URI faculty or staff member, to pursue independent projects on the agency's behalf.



At work. Coastal Fellows in the field, recording water table depth and studying movement of nitrogen through the watershed.

Experiential model

The Coastal Fellows model is clearly a powerful one for faculty and students, researchers and communities alike—potent enough to inspire the URI Department of Natural Resources Science to implement a paradigm shift in educating all its majors. The new curriculum encourages students to pursue fully one-half of the work in their major through hands-on, experiential opportunities such as the Coastal Fellows Program. This represents a radically different approach to education and a stark departure from other models on campus.

The new curriculum blends traditional classroom instruction and hands-on experiential learning with student reflection and synthesis to solve real-world problems such as those addressed in university research and outreach settings. The model curriculum embraces and extends the concept of vertically oriented learning teams, fostered by the Coastal Fellows Program. It provides a variety of learning opportunities throughout

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a student's time at URI—from the first semester of freshman year through the senior year. These opportunities include internships, Coastal Fellowships, cooperative education placements, research apprenticeships at different academic levels, teaching practica with faculty, student-generated research and senior theses. Other hallmarks of the curriculum are peer teaching and mentoring and inquiry-based approaches to learning.

This type of radical revision requires faculty supervision to ensure academic legitimacy. The Natural Resources Science Department has structured a system that will establish expected learning outcomes for each student and set criteria and rubrics for measuring student achievement. In the near future, a dynamic portfolio system—in conjunction with careful advising and mentoring—will require students to demonstrate competency and achievement of educational goals. A senior capstone course asks students to demonstrate their capacity to synthesize knowledge by addressing a real-world problem. Seniors present their best research or outreach effort to a forum of faculty and peers.

The Natural Resources Science curriculum is attracting large numbers of students, and four other departments are moving to institute a similar curriculum. Why is this approach gaining momentum? For faculty, the chief reason is the opportunity to spend more time working and teaching within the context of their research. University administrators see an opportunity to reduce seat time and thus costs. Graduate students learn valuable teaching and mentoring skills. Undergraduates—the primary beneficiaries—gain substantive experience in their field, along with close connections to faculty, staff and other students in team settings. Communities tap a powerful resource for solving local problems. Ultimately, this new paradigm offers a venture of discovery in which everybody wins.

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