POLICY FORUM

EDUCATION

Teaching in a Research Context

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Unknown to many university faculty in the natural sciences, particularly at large research institutions, is a large body of recent research from educators and cognitive scientists on how people learn (*1*). The results show that many standard instructional practices in undergraduate teaching, including traditional lecture, laboratory, and recitation courses, are relatively ineffective at helping students master and retain the important concepts of their disciplines over the long term. Moreover, these practices do not adequately develop creative thinking, investigative, and collaborative problem-solving skills that employers often seek. Physics educators have led the way in developing and using objective tests (*2*–*4*) to compare student learning gains in different types of courses, and chemists, biologists, and others are now developing similar instruments (*5*–*7*). These tests provide convincing evidence that students assimilate new knowledge more effectively in courses including active, inquiry-based, and collaborative learning, assisted by information technology, than in traditional courses (*3*, *4*).

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In spite of this, introduction of new instructional methods has been slow and difficult across all the science disciplines, for similar reasons. In the current culture of academic biology, particularly at large research universities, efforts to improve faculty teaching effectiveness are generally neither encouraged nor highly valued. Most faculty are unaware of the recent results from learning research or the evidence that application of these results can benefit their own students. Most leading biological journals do not publish articles on education research, and few life scientists read the educational journals that do publish these articles or the National Research Council (NRC) reports that have reviewed them (*1*, *8*–*11*). National meetings of most professional societies in the life sciences now include sessions on education, but these generally precede or follow the main meeting and are poorly attended.

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Consequently, there is little incentive to question or change traditional practices.

How can we accelerate dissemination and adoption of more effective teaching methods for large university courses? Again, physicists have led the way (*12*, *13*), but an ongoing revolution is also gaining momentum in the life sciences. One recent event was creation by the Howard Hughes Medical Institute of HHMI Professorships, each funded with $1M over 4 years. The first round of these awards was made in 2001 to 20 scientist-educators for development of innovative programs and materials that would integrate research with teaching. Besides promoting seminal work in education, these awards sent a strong message that improving undergraduate instruction is worth a major investment (*14*).

A second development was launched this past August, when 37 scientists and educators gathered for an unusual meeting at the University of Wisconsin, Madison. It was sponsored by the NRC and organized with help from the university's Center for Biology Education, as a follow-up to the recent NRC report *BIO2010* (*15*, *16*). The meeting initiated a series of summer institute courses for biologists, modeled after the intensive Cold Spring Harbor biology research courses but designed to improve skills in pedagogy rather than laboratory research. The participants included HHMI professors, members of the National Academy of Sciences, biological scientists already active in educational initiatives at large research universities, educators from physics and chemistry, and junior faculty members (representing the target audience for future summer institutes).

One purpose of the meeting was to share experiences and novel teaching applications, through presentations and workshops in which attendees played the role of students in an active-learning classroom. Another was to plan future institute courses.

The planned courses, under the auspices of the National Academies Summer Institute on Undergraduate Education in Biology (*17*), will bring together small groups of scientist-educators (facilitators) with junior and senior life sciences faculty members (participants) who wish to become more effective teachers. They will participate in intensive presentations, demonstrations, and hands-on workshops. Admission will be competitive, favoring teams of two faculty members from the same campus, preferably involved in teaching large introductory biology courses. Applicants will be judged on a written proposal describing how their experience at the institute could benefit their own teaching as well as help to initiate change in their departments. Graduates of these courses, who will be given an honorific title by the National Academies and possibly a small stipend for the year following their participation, will be expected to promote reform efforts among their colleagues when they return home, with continued support from their mentors and the peer group at the Institute. We hope their impact and reach can be extended through similar efforts in other disciplines.

References and Notes

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