

THE LINK BETWEEN RESEARCH AND TEACHING

2. How to Strengthen Each Without Weakening the Other

RICHARD M. FELDER

North Carolina State University

RECAP OF PART 1^[1]

Research productivity is the dominant criterion for tenure and promotion at most research universities in the United States, and it's becoming increasingly important at institutions that used to have only teaching missions. This policy has hurt the quality of education at many universities by denying some outstanding teachers tenure, and it has also led to a lot of mediocre research.

The usual justification for the policy is an assertion that research and teaching are inextricably linked, to an extent that only active researchers can be effective teachers. While research activity is no doubt an important qualification for teaching and mentoring graduate students, its connection to undergraduate education is far from obvious. Prince, *et al.*,^[2] recently surveyed the literature on the connection and found that while disciplinary research can support teaching in principle, it generally doesn't in practice. Significant positive correlations have not been found between individual faculty research productivity and teaching effectiveness, or between institutional research productivity and student learning and satisfaction. (In fact, most correlations of both types have been negligible and sometimes negative.) Most faculty members do not integrate their research into their undergraduate courses, and many who attempt it waste valuable class time on material irrelevant to the course objectives or too advanced for the students' backgrounds. Undergraduate research does provide benefits, such as improving retention of some student populations and influencing some students to pursue graduate study.

As a rule, however, only a small subset of the student body participates in research, the participants often function more like unpaid lab assistants than real researchers, and research activity has not been shown to significantly enhance students' learning and skill development. (See Reference 2 for citations of the studies that produced these findings.)

STRENGTHENING THE LINK

Prince, *et al.*,^[2] offer several proposals for strengthening the research-teaching nexus, including these:

- *Encourage faculty members to use inductive teaching methods (e.g., inquiry-based, problem-based, and project-based learning).*

An instructor may effectively promote learning by teaching in a manner that emulates elements of the research process. Inductive methods such as inquiry-based, problem-based, and project-based learning do that. When implemented correctly,

Richard M. Felder is Hoechst Celanese Professor Emeritus of Chemical Engineering at North Carolina State University. He is co-author of *Elementary Principles of Chemical Processes* (Wiley, 2005) and numerous articles on chemical process engineering and engineering and science education, and regularly presents workshops on effective college teaching at campuses and conferences around the world. Many of his publications can be seen at <www.ncsu.edu/effective_teaching>.



they facilitate students' attainment of high-level thinking and problem-solving skills^[3] and can reach more students at a lower cost than undergraduate research can.

- *Engage a substantial percentage of the student body in meaningful research.*

The impact of undergraduate research is limited if only a relative handful of students participate in it, while involving many students can add considerably to the quality of a department's teaching program. Simply giving students projects is not enough, however; for undergraduate research to be effective, the advisor must really mentor the students and not just treat them as additional pairs of hands to help out in the lab.

- *Formally recognize and reward faculty members who successfully integrate teaching and research.*

Successful integration might involve relevant incorporation of the instructor's research into course lectures, assignments, and exams; using inductive teaching methods and demonstrating their effectiveness; and guiding students through well-conducted research projects. If such activities are explicitly included in annual faculty performance evaluations and they count in tenure and promotion decisions, they will eventually become part of the academic culture.

STRENGTHENING BOTH RESEARCH AND TEACHING

Strengthening the linkage between research and undergraduate teaching can improve the latter, but only to a limited extent. As long as excellence in research is routinely rewarded with tenure and promotion and excellence in teaching is occasionally recognized with an award, teaching quality will be well below what it could be. The following two steps should improve an institution's teaching program dramatically without sacrificing its research productivity and quality.

- *Make sure each department has some faculty members (at least 10%) who specialize and excel in teaching and educational scholarship.*
- *Treat performance in teaching/educational research and disciplinary research identically when tenuring, promoting, and rewarding faculty members.*

The idea is not to reverse the positions of research and teaching in the faculty reward system to make teaching dominant. Frontier research is critical to the future of our society, and it is vitally important for universities to keep doing it since industry has largely abandoned research that doesn't promise a quick payoff. But just as not every teacher has the aptitude to be an excellent researcher, not every researcher is capable of

being an excellent teacher. Some professors manage to excel at both—almost every department has a few—but there are not nearly enough of them to populate all department faculties.

So, in addition to hiring and promoting people who are outstanding disciplinary researchers and adequate teachers, every academic department should make room for some outstanding teachers and educational scholars who do little or no disciplinary research. Those individuals will keep up with innovations in pedagogy and instructional technology and share their knowledge with interested colleagues to help them improve their teaching. They will teach important undergraduate courses (such as the engineering lab and capstone design course) that most research-oriented faculty members have little interest in teaching, and help students acquire critical professional skills (communication, teamwork, ethical awareness, etc.) that traditional faculty are often reluctant to include in their courses. There is also a somewhat self-serving argument. Being outstanding teachers, the specialists will motivate their students to learn and inspire them to grow. Alumni tend to remember such teachers fondly throughout their lives, and when they are asked for discretionary donations or endowments of scholarships, named chairs, and new labs and buildings for their alma mater, those memories often lead to generous responses. (All universities have such stories.)

Administrators commonly fear that hiring and promoting education specialists will cause a reduction in institutional research productivity, but that doesn't have to happen. Some traditional faculty members freed from unwanted responsibilities will find the time to write additional proposals, and the education specialists should bring in some of the millions of dollars of funding awarded every year for research on teaching and learning. Having education specialists on the faculty will allow most research and teaching to be done enthusiastically and expertly by people who enjoy and excel in those activities. As long as the specialists are held to the same high performance standards for tenure and promotion that are applied to traditional research faculty and they are rewarded equally for success, everybody wins.

REFERENCES

1. Felder, R.M., "The Link Between Research and Teaching. 1. Does It Exist?" *Chem. Eng. Ed.*, **44**(2), 109 <<http://www.ncsu.edu/felder-public/Columns/Nexus1.pdf>> (2010)
2. Prince, M.J., R.M. Felder, and R. Brent, "Does Faculty Research Improve Undergraduate Teaching? An Analysis of Existing and Potential Synergies," *J. Eng. Educ.*, **96**(4), 283 <[http://www.ncsu.edu/felder-public/Papers/Teaching-Research\(JEE\).pdf](http://www.ncsu.edu/felder-public/Papers/Teaching-Research(JEE).pdf)> (2007)
3. Prince, M.J., and R.M. Felder, "Inductive Teaching and Learning Methods: Definitions, Comparisons, and Research Bases," *J. Eng. Educ.*, **95**(2), 123 <<http://www.ncsu.edu/felder-public/Papers/InductiveTeaching.pdf>> (2006) □

All of the *Random Thoughts* columns are now available on the World Wide Web at http://www.ncsu.edu/effective_teaching and at <http://che.ufl.edu/~cee/>